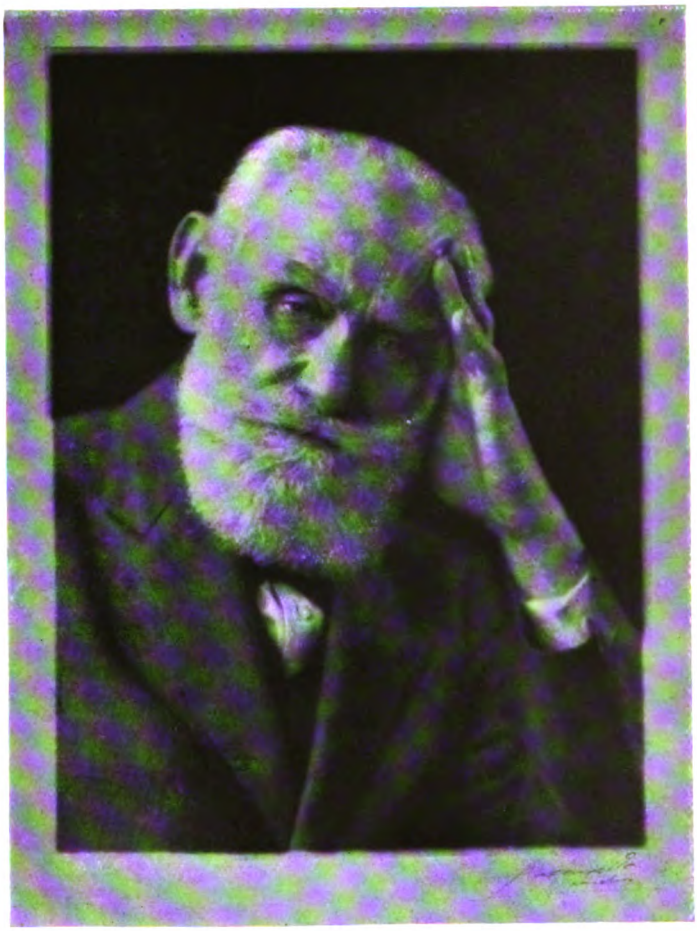

IVAN PETROVITCH PAVLOV

PSYCHE

JULY, 1926

EDITORIAL

THE RAPE OF THE LOCK

One of the most interesting of the observations recorded in Köhler's studies of the Mentality of Apes was occasioned by a banana. The apes had no bananas on a given day, though desirous of same with a view to consumption. An inviting specimen of the fruit was therefore hung just out of reach, except to an animal perched on two boxes, one on top of the other. The difficulty of placing the boxes so that they remained stationary long enough to permit a successful grab proved insuperable: climbing and falling did not teach its lesson.

Now if the 'Gibbon's Climb and Fall'—more widely known as the process of 'trial and error'—failed to solve the problem, what was lacking? All the materials were there in the cage: a banana, desire, two boxes, and four limbs. Should our anthropoid ancestors have undertaken research into boxes, or bananas, or desires, or limbs? Should they have waited for the discovery of fresh facts outside the cage by future generations of apes? Or should they merely have set quietly about using a couple of perfectly good boxes properly?

More generally—what has prevented the elephant from learning to talk, and men from learning to fly? What more difficult than the discovery of the art of writing? Why could not he who initiated the A B C proceed straightway to the B B C and the C B C without waiting for Professor Low and Dr. Stopes? There was, it seems, nothing about gunpowder or printers to prevent the Chinese from unveiling their mysteries in the remote past, nothing about the age of Galileo and Copernicus to conceal its discoveries from that of Plato and Archimedes.

The historian who shall explain why the Past has so often failed to forestall the Future will tell us that the Key we seek has often been there all along: it is the Lock we should have sought. The cosmic consciousness has looked for its braces everywhere but on

its back. With a frenzied rifling of cenotaphs we push constantly against a door which opens inwards.

And so it may be with the problem of the Psyche. Is it really more knowledge we want, or more understanding? Are we in fact clavigerous and fail to realize the aperient properties of that which is in our hand?

From time to time we have had occasion to record in these pages the utterances of eminent authorities in other fields, for whom Psychology apparently holds the key to the enigmas with which the world supposes them to be struggling. One day it is Professor Eddington who maintains, inadvertently perhaps, that the universe of the physicist is but a projection of the mind—of the processes with which psychology is concerned. The next it is Freud, who may yet persuade the Royal College of Physicians itself that the healing art should resolve itself into an analysis of mental misbehaviour. Anon it is Trotsky who, after slaying his ten thousands, announces to the moujiks that without a study of modern psychology the U.S.S.R. will become as naught. And now it is the turn of the chemist, as anyone can satisfy himself who studies the monumental text-book of *Cytology* published by the Cambridge University Press and edited by Professor Cowdry of the Rockefeller Institute for Medical Research. Professor E. B. Wilson contributes an Introduction, Professor T. H. Morgan the concluding essay, and the General Aspects of the problems are surveyed by Professor A. P. Mathews of the University of Cincinnati.

Professor Mathews is concerned with the Chemistry of Cells, and it is chiefly by his orientation that the outlook of the chemists of the next generation will be determined. And here we find him announcing to cytologists that " the psychologist of the future will discuss the psychology of hydrogen, of oxygen, indeed that of the electrons, positive and negative, themselves." For, says he, " the atoms are the same in living and lifeless, and every moment they are turning from the one to the other. As Du Bois Reymand puts it, the atoms of iron in the great driving wheel of the locomotive and in the brain of the poet are the same."

But more than that. Energy is now regarded as particulate. It is not radiated uniformly, but in units, quanta. The units into which the ether crystallizes are, when irreversible and animate, electrons, and when larger and reversible they make a ray of light. Light may be a progressive, partial, and reversible formation of large electrons out of the ether; and we may find " that psychism, too, is particulate and made up of units which we may call psychons."

Now if we were content to leave the matter here we might conclude that the cytologists had been indulging in a little harmless

verbal speculation—and proceed without more ado to the cytology. But the modern scientist is not content to raise his eye to the skies on Sunday, and don his terrestial blinkers for the rest of the week. At least he has the courage to follow the logic of his formulations and to attempt to orientate his possible conclusions in relation to those of other researchers. " Hence the biochemist sees that the solution he seeks is not immediately before him in the discovery of the nature of enzyme action as some have thought, but must await the development of psychology into a science." Or, more emphatically, " like the physicist, the biochemist must await the development of the final science, psychology."

This, though in another sense and more modestly stated, has often been the claim of *Psyche*. For to the student of language it should be clear that the branch of psychology which bears most directly on these apparently ineffable issues is that which deals with symbols, with the words in which questions are asked, the formulæ in which dilemmas are stated, and which minds the symbolic machinery whose parts are so often mistaken for fragments of the external world.

Unfortunately it is at present the business of nobody in particular to study this machinery, though its defects are daily becoming more obvious. What psychology needs to-day is an Institute of Linguistic Research, with an endowment of £100,000, to make possible further work on the borderlands of neurology, anthropology, pathology, philology, grammar, and physics. Then psychology might give real assistance to workers in other fields. It need no longer stand key in hand, yet unable to discover the still virginal lock which the incrustations of long ages of verbalism so effectively conceal.

ALMOST HUMAN

One of the characters which distinguishes man from the apes is said to be the power of handling statistical material with profit. Not all humans are equally gifted in this respect; indeed, in the case of psychology the value of the statistical approach has been the subject of much controversy. The fascination of figures remains, however, and many psychologists succumb; but it is not often that we find anyone using them with such confidence as V. G. V. Hamilton in his *Introduction to Objective Psychology* (1925), to which Professor R. M. Yerkes (author of *Almost Human*) contributes a glowing eulogy by way of Foreword. Professor Yerkes tells us that " Hamilton's discoveries are undoubtedly of fundamental and far-reaching importance. . . . I venture to predict

that he will presently find himself the leader of a school of psychopathology which will importantly modify our current conceptions."

Here are three of the conclusions to which his statistical material (200 cases in a small city) leads our future leader (pp. 202–3) :—

"Widowhood seems to be more conducive to nervousness in women than in men."

"The third, fourth, fifth and sixth decades represent the period during which nervous disorders are especially apt to develop."

"After sixty, death . . . is an important factor in the reduction of the incidence of the so-called functional nervous disorders."

IVAN PETROVITCH PAVLOV

We publish as the frontispiece of this number a new portrait of Ivan Petrovitch Pavlov, who will celebrate his seventy-seventh birthday early in the autumn.

Pavlov's researches are of vital importance to modern psychology, and his work on the Conditioned Reflex is the foundation on which Dr. J. B. Watson has built Behaviorism. The relation of Pavlov's results to the new theory of Chronaxy are discussed elsewhere in this number by Mr. C. K. Ogden.

THE ADJUSTMENTS AND UNITY OF THE ORGANISM

By WILLIAM A. WHITE, M.D.

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The study of the mind was largely absent from the curriculum of medicine in past years. The interests of the doctor were directed almost exclusively to the body. Yet what good is the body unless it is possessed of a mind that has the capacity to make a place for itself and to find satisfaction in its activities and in the activities of the body? If we have a body, and even if we can keep it well, if it is only that and no more, we have not gone very far. Medicine and hygiene that can merely keep the body in order have not benefited enough from efforts in correlated fields of science. It is important for us to apply the scientific methods of study to the problem of the adjustments and unity of the organism from the point of view of the mind.

I wish briefly to sketch the underlying principles of the structure of the organism.

The One-Celled Organism

Let us start with an organism that consists of but a single cell. We find in this nothing that corresponds to the many and diverse structures found in higher organisms, as for example, organisms like ourselves. It is a little bit of something in which the living functions are present—it moves, it takes food, it responds to disturbances, it excretes wastes, it reproduces—but we get the impression that it is a more or less homogeneous mass and we search in vain for definite organs. Yet there are minute structures present which, while they correspond to nothing in higher living things, may have functions of which we know nothing.

These one-celled bits of living matter are capable of nourishing themselves by enveloping bits of suitable material and incorporating these within their own substance. The material thus taken in and liquefied diffuses through the jelly of the organism from part to part without being carried along any definite route or system of transportation.

Throughout we find what seems to be a lack of organization in simpler cells. Not only does the material taken in spread out in every direction without following definite structural paths, but the same seems to be true also for incoming waves of energy. These pass from part to part of the cell and do not seem to follow a definite structural path.

If we throw a stone into a pond, waves spread out in all directions and gradually disappear. If we throw a second stone in at the same point before all the waves have disappeared, the new waves will also die out. If we imagine, however, a pool of jelly-like material into which a stone is thrown, we may conceive that a second set of waves and a third might result in a permanent structure by the time the jelly has set.

Tendency Toward Definite Structures

There is a tendency in the living matter for the paths of energy to become permanent; or there is a tendency for the energy to travel along lines previously travelled. In the same way, there is in living matter a tendency toward structuralization. There are vague beginnings of definite tracts which ultimately become permanent. These energy waves tend to become permanent, and energy travels most easily along the paths that have been previously laid down.

Time does not suffice to trace that tendency by citing examples all the way up to the human organism. It is enough for our purpose to emphasize that in this tendency is the beginning of what I like to call the *structuralization of function.* In other words, the energy of the stimulus tends more and more to bring out, along the paths of its discharge, definite tracts which are ultimately rendered distinct structures. Just as the water from a heavy rain-storm washes over the side hills and gradually channels out for itself little canals in the soil and ultimately channels out the river bed, so these discharges of energy channel out for themselves in this semi-gelatinous protoplasmic mass through-pathways that, as time goes on, become deeper and deeper until they become permanently organized. This permanent organization is transmitted and becomes ultimately a part of the structure of the organism.

Now, to take a little jump, we find that these organisms very soon after they pass this simple stage, tend to become organized along certain plans, so that we have organisms built up in patterns of symmetry.

We have, to begin with, the anterior-posterior, or the frontal type of symmetry, the differentiation of the front end of the organism from the rear end of the organism. And we have a symmetry which is from side to side. Then we have the

symmetry that looks out from the surface downward, that is, the dorsal-ventral symmetry.

So we very soon find that these little organisms have a head end and a tail end, and a right and a left, and an upper and a lower.

Dynamic Gradients

Experiments have been worked out in the laboratories whereby it has been shown that the energy in the organism is highest at the point where the stimulus is received—at the head end for example. And, as we go backward from the head end, the energy is less and less intense. This tapering of the energy intensity is called the *dynamic gradient.* So it can be shown by experiments that the paths are from the front to the rear end of the organism; and the surfaces above and below act in the same way. That is shown rather interestingly by the capacity with which the organism absorbs certain substances. Vials of various substances can be placed upon the water so as to diffuse the material out slowly, and it then appears that an organism which is capable of absorbing any of these substances absorbs more rapidly at that portion of the gradient which is most active and where the energy is at the highest tension.

'Mind'

There are two or three things to which I wish to call attention from this simple account of organisms in general. The first is that the head end of the organism appears early in the evolution of animal life, and that there are two types of distribution of energy which this organism shows. One is the distribution of energy along these dynamic gradients, and the other is the transportation of chemical substances throughout the organism along paths that develop along with the organization of these gradients.

So we see that the little single-celled organisms already have a head in effect, if not in structure, and many who are working in the field believe it is proper to say that they have the beginning of what we call 'mind'. It is not, of course, a mind that is comparable to what we know in our personal experience as mind, but a mind that is just as comparable to the mind that we possess as the physical make-up of that simple organism is comparable to the infinitely complex physical make-up of our own body.

The Unity of the Organism

From the point of view of a general definition the mind is nothing more nor less than the final representation of the function of the organism as a whole. When we talk about a man's liver or his heart or his kidney, we are talking about parts of his organism, and we

are interested in physiology. But the minute we ask the question, What is the *man* doing ? or in other words, as soon as we incorporate in our query about the organism words that indicate we are dealing with the whole individual, then we are necessarily speaking in psychological language. So when we say, What is the monocellular organism doing ? we are speaking in psychological language. Speaking from the point of view of bodily make-up, we find, then, that these unicellular organisms represent in their very beginnings the simplest forms of the structures that through millions of years of evolution ultimately result in the complex organisms with which we are familiar. In the same way, we think that we find here also the beginnings of psychological types of reaction, though wonderfully simple as compared with the psychological types we see in human beings.

Two Types of Organization

We may start by saying, therefore, that there are two types of organization. The first type, familiar in all the higher organisms, is that in which there are definite structural paths for the transmission of energy, as well as definite structural paths for the transportation of materials. In the other type, represented by the simplest living things, transmission of energy and transportation of materials go on without such definite structural channels. The unity of the organism, which is effected by what we call the 'mind', is just as characteristic of life on the lowest levels as it is of life on the highest levels. The mind is as old as the *soma*, or body.

Now, we cannot expect to understand the mind in any other way, or by any less severe discipline, than we understand the body. We must study its history as it has developed through the ages in the same way as we study the history and the development of the body. It is the way of science by which we have come to learn so much about the body; and it is by the same way that we are coming to learn so much about the mind.

The Elementary Nervous System

To leave the chemical method of transportation out of the picture for the moment, let us trace some of the outstanding features of the development of the nervous system, to see how this scheme of development follows along. If we go up a little higher in the biological scale, we come to certain many-celled organisms. Compared to the one-celled organisms, multi-cellular organisms are rather complex; but still these are very simple when compared to the vertebrate type. We find a type of nervous system which is called a *net-work* nervous system. On the surface of these organisms

having such a nervous system we find a point that is modified somewhat for the reception of a stimulus. In a remote part of the body we find a point that is modified for reacting to that stimulus.

For instance, the tendrils or tentacles of the sea-cucumber receive the stimulus, and there is a muscle fibre surrounding the bases of the tendrils, so that these react and contract when the stimulus is received. Connecting the so-called receptor and effector organs, we find a little fibre of nerve running along. These nerve fibres are distributed in what appears almost a haphazard way. They look almost as if those lines of force of which I have just spoken had, as a matter of fact, been laid down in structureless protoplasm, because they are not grouped in strands like the electric wires and copper cables which are found in a modern building. They are scattered here and there, but are always connected with a receptor organ, and have an acting organ at the other end. This is called the net-work type of nervous system because the nerve elements are distributed like the fibres of a net.

The interesting thing here is that the action or behaviour of the organism is very definitely determined. When the stimulus falls upon a certain part of the organism, it communicates, so to speak, the result of that stimulus to the distant point at which the other end of the nerve is connected, and a reaction follows with almost absolute mathematical accuracy. The organism is therefore, to a certain extent, entirely dependent for its life and existence upon the sort of stimulus it receives. Such organisms, for example, do not go out in search of food; they attach themselves to a rock and wait for food to float along. When food touches them, these tentacles contract and they drag the food into the mouth. They go on living in a rather casual and automatic sort of way.

The Central Nervous System

When we proceed still further up the scale, we find that nerve fibres begin to be gathered in definite pathways, bound together in strands more like an electric cable. These strands run in definite parts of the organism. We find in the anatomy of an ordinary earthworm, for example, a cable running along each side the middle of the earthworm on the ventral side of the food tube, and connected across at each segment until the double chain gets to the head. And there we find a great accumulation of nervous matter. Even here we probably have a very deterministic type of nervous system. It does not leave the organism much chance for variation in its conduct.

There is an interesting story connected with this type of nervous system which I want to tell because, while it may or may not be true, it shows the wonderful things that nature perhaps can do.

This nervous system goes up on either side with connecting strands across until it gets to the front. Then there is a ring or circle of nerve fibres surrounding the esophagus or gullet. This gullet is part of the food tube, food passes through it on the way from the mouth to the stomach. The ring of nerve fibres around the gullet is typical of all the segmented worms and of all the arthropoda, or jointed-leg animals, a large group that includes the insects, spiders, and crustaceans (lobsters, crabs, etc.).

An eminent English biologist spent many years trying to find out how this type of nervous system finally developed into the type of nervous system which we have, the system which belongs to the vertebrate or backboned animals, characteristic of what we may consider the high minds. He developed this theory which I will outline very briefly. I do not know whether it is true or not, because it has never been verified. It would take a lifetime to verify it, and no one has as yet shown a tendency to devote the major part of his life to see if it checks up.

Brain Versus Food

These segmented organisms were dependent upon food, as all of us are; and the food became scarcer and scarcer so that they had to develop brains in order to devise methods of finding food when it was scarce. The type of organism of which I am talking belongs at about the level of the spider. You know how the spider has solved that problem for himself. He has quite a large brain of this type, but the brain has increased so much that there is but very little room through that circle of nervous tissue for food to pass. As he no longer is capable of eating food, there being no room for it to get through, he catches flies and sucks the fluid from their bodies, and that fluid is his food.

The point reached by the spider, then, is this—he had to have brains, but the more brains he got the more they shut down on his food-tube, and if he developed too much brains he would starve to death; on the other hand, if he did not get food he would also starve to death, and he could not get food without developing brains. That is a difficult position to be in; and, as Professor Gaskell said, at that point in the history of evolution, living organisms, so to speak, had to decide whether, in the future, life would be a matter of belly or a matter of brains. One or the other had to give way.

Now an extraordinary thing happened. A new intestinal tract was developed outside of the nervous system. The old gastro-

intestinal tract ran right up between the bars of nervous fibre; but the central nervous system of vertebrates is developed on the back or dorsal side, and the gastro-intestinal tract lies ventral to it. There are some very interesting things to show that that happened. The brain and the spinal cord are hollow organs; there is a series of ventricles, or cavities, in the brain, and a long ventricle running down the spinal cord. These are supposed to be the relics of the old gastro-intestinal tract that was destroyed by the vertebrates.

At the base of the vertebrate brain is the pituitary gland. Right through the centre of the pituitary gland there runs a little channel, and that is the remains of the old esophagus of the spider. It is there to-day and the pituitary gland is made up of two distinct parts: one of these comes, during the development of the embryo, from the upper portion of the esophagus; and the other is derived from the nervous system. So we have within us to-day the trace of this old conduit, and we have to be thankful that the conflict between belly and brains was decided in favour of brains.

The Brain

That type of nervous system which the segmented animals have is called the step-ladder nervous system, because of its resemblance to a ladder. Some of these invertebrata, as soon as they got rid of the incubus of the gullet passing through the centre of the brain, developed a different type of nervous system which was no longer subject to the old limitations; and the principal element in that nervous system was the head end, or the brain. In all the long history of the development of the nervous system, there is evidence of the gradually increasing size and increasing complexity of this brain.

We were able, by discarding the old gastro-intestinal canal, and by developing a nervous system that was so located as not to be subject to those old limitations, to develop a nervous system which was capable of indefinite size. And while the brains of lower vertebrates like birds and fish are perfectly smooth, we find that the brain of man and the higher mammals is thrown into corrugations. The effect of this wrinkling is that there is a much greater amount of surface in the same limited space. If the gray matter covering the corrugations of the brain were spread out it would occupy a surface of about four square feet; and that is all condensed into the skull.

The portion of the brain that has to do with the highest functions has developed more rapidly than any other, and that highest portion of the brain consists of the hemispheres of the cerebrum. These have become so large that now, as we look down upon the brain

from above, we can see nothing else; they spread over all other parts. We look down upon the brain of a fish and we find all the parts serially related; if we look down upon the brains of men, we see nothing but cerebral hemispheres.

In the course of evolution, therefore, an organ has been brought into existence that has apparently untold capacities for development. We are inclined to believe that the kidney, liver, spleen, and the rest of the internal organs, even the spinal cord itself, and the more simple portions of the nervous system, have probably reached, for all practical purposes, the limits of their development. But in the brain, the cerebral hemispheres, so far as we can see, may continue to increase not only in size, but in complexity.

The Cortex of the Brain

We have in these cerebral hemispheres a thin covering called the cortex. This cortex is but two or three millimetres in thickness, less than an eighth of an inch. We have in that two or three millimetres of coverage fragments of nerve centres, each one of which is infinitely more complex than the single monocellular organism we started with.

I do not suppose that those billions of cortical cells can be connected up in every combination that is mathematically possible, but with billions of cells the number of combinations is for all practical purposes quite unlimited. We evidently have here an organ which is capable of indefinite broadening, indefinite development, indefinite elaboration.

We have other organs that develop to such a point of complexity or perfection that we do not require of them any further development. After all, we are no longer living in a civilization where brawn and muscle and bone are of so much importance. Thanks to the spider, we are living in a civilization in which brains are of the greatest consequence, and all we need from the other organs of our body is to maintain these brains sufficiently so that they can do their work.

Multiple Discharge

Now another element of enormous significance has entered into the situation. In speaking of the net-work type of nervous system, I said that there was a single fibre connecting a receptor organ with an effector organ, and that therefore any stimulus discharged to an absolute finality. It was delivered at a certain point and there was no possibility of sidetrack.

In the nervous systems of higher mammals the cortex has developed a different kind of scheme. It has developed what we

call the synaptic type of nervous system. When a stimulus starts (I pick up my watch, for instance, and I have certain feelings in the ends of my fingers), it travels up the nerves of my arm until it gets to my cortex. It does not result in a single, absolute, determinate response. I can put the watch down, turn it over this way, or throw it across the room, or do a thousand different things with it. What is the structural foundation that makes it possible to do any one of a thousand things from a single stimulus ?

The nerve that travels up my arm to my brain does not travel directly back to the muscles; it stops in the spinal cord, gives off a large number of little fibres, and those fibres in turn run toward innumerable other fibres without being organically a part of them. It runs close to these, and almost touches them, but not quite. That place where fibrils from different nerve cells come close together, but do not quite touch, is known as the synapse. It breaks the current. The stimulus that travels up my arm comes to a certain point, and then instead of being absolutely determined in a single, specific direction, it can go in any one of innumerable directions according to which path is finally chosen. In this interval which takes place between the reception of the stimulus and its starting off on one of the many spinal cord pathways—in this delay which we know of as the time factor in the travelling of nervous impulse—in this interval, we believe, are born thought, doubt, choice, and all of those functions which we associate with the higher activities of the mind.

So much for the evolution of certain types of adjustive mechanisms. We have seen that our body is made up in this sort of way. Now what are the capacities within it for adjustment ?

Reserve Capacity

In the first place every organ we have in our body is furnished to us in quantity far in excess of what we need for ordinary purposes. We are familiar, for example, with machines of one sort and another. A dynamo may be rated at three hundred and fifty horse power, yet we know perfectly well that that dynamo will run efficiently if it has to deliver four hundred and fifty horse power. In a similar way every organ of our body is furnished in sufficient quantity so that it can deliver at least twice as much as its rated quantity of service, so to speak, and sometimes more than that.

For instance, in the case of the kidneys, it is possible for a surgeon to remove one kidney and leave the other to do the work for the whole body perfectly well. It may grow a little larger in doing it, but it has the capacity for growing larger. We say, then, that it is hypertrophied or over-grown because of the additional demand.

So we may get along very well with one kidney, but we have two, as a sort of factor of safety.

All of us would have a terrible time with our hearts if they were not able to stand the additional loads of one sort and another which we put on them. Whenever we exert ourselves we put a double demand upon our hearts. Similarly, every organ in the body is capable of adjustment within a wide range, depending upon the demands that are made upon it.

Function Precedes Structure

There is one other aspect of the organism which is still more important from the point of view of adjustment, and that is the mind. I have already indicated, by implication rather than directly, that mind was largely a function that has not yet become structuralized. It uses the structure, to be sure, that it finds at hand and ready to use, but it is still largely unstructuralized.

Some philosopher has said that matter is mind hidebound by habit. We might paraphrase that and say that the structures of our bodies originally were mental and have gradually become bodily functions. It may seem at first to be transposing what we ordinarily think of as ' cause ' and ' effect ' to say that the function leads to the formation of structure, instead of saying that structures produce or result in functions. The fact remains, however, that in the development of an individual organism the embryo absorbs and assimilates food before it has any special digestive organs, its cells use oxygen and discharge the products of oxidation before it has any special breathing organs, and so on. In the same way, as we have already seen, the essential life functions appear in the lowest types of plants and animals long before there are any definite structural instruments for any specific function. As the functions have been performed over and over again, the organism has established a certain type of response which has survival value.

Survival Values

Fish may swim into water which is too hot for them, and in which they would perish; but when a fish brought up in warm water starts toward the Arctic zone, it will turn back when it gets to the colder waters. It keeps where it can continue to live. That reflex turning back is a function which has been laid down in the structure of the organism. It is a life-saving function, a function that has *survival value.*

Whether or not I talk for five minutes more when lecturing, or what I say within reasonable limitation, would not have survival value. I might say some things, perhaps, which would result in

my disintegration by an enraged audience, but I am not liable to try that. Ordinarily the things that I would say mean very little so far as whether I live or die within the next two years is concerned. They have not survival value. Therefore, there is no reason why they should be laid down in structure, because structure determines a definite and fixed type of reaction for all time. Moreover, we cannot lay down functions in structure until we have tried them out over and over again, millions of times, through thousands of years, and are sure that we are right.

So it came about that what we call the mind remains function that is not structure, and therefore is very adaptable. Mind is like the fluid of the monocellular organs, the fluid protoplasm, or still water in the pond. It can be thrown into waves in any direction, from a given stimulus. That is probably not an accurate analogy, but, relatively speaking, it is helpful. The mind represents in large part the fluid capacity for readjustment which we all carry along with us. It gives survival values in circumstances where we would find fixed responses fatal.

Automatic Mind

Now there are certain parts of our organism which represent stages that are intermediate between this fluid quality of mind and definitely laid down structures. I refer particularly to the lower, older portions of the nervous system which control the viscera, the internal organs, and the so-called endocrine glands that we hear so much about to-day. The function of these glands is to secrete certain chemical substances which travel to various parts of the body through the blood and the blood vessels, and so we still maintain to-day the old transportation type of adjustment which we had when we were monocellular organisms. This transportative type of adjustment represents organically what has not been laid down in definitive structures.

Reproduction

There is one very interesting correlation to which we have come from all this study. Professor Charles M. Child, of the University of Chicago, in defining his theory of the dynamic gradient method of organization, made original experiments with flat worms. These organisms are only little things about a quarter of an inch long, but they are very easy to experiment with, and he found in studying these worms a very interesting method of reproduction. These worms grow, and they grow to a certain definite size. They crawl along the ground by a sort of wavy wriggle. When they get to a certain size, what happens? The rear end of the worm sticks to the

stone upon which it is crawling and the forward end of the worm keeps on crawling, the strand between gets thinner and thinner, and finally the forward end of the worm breaks off and leaves the rear end attached to the stone. Then the rear end immediately develops a head and starts off on an existence of its own. This is the way reproduction takes place. We see what has happened.

By dynamic gradients, we must remember, we mean that the greatest amount of energy is at the head end and the energy dwindles off toward the tail. When the worm gets so big that the energy at the head end cannot travel the whole distance, it peters out, it no longer can control any more worm, and the worm that it can't control breaks away and starts out on its own independent existence.

That is exactly what happens in human society. We form an organization. We have two or three hundred members, and by and by we get so we can't keep it together. The various factions in the organization become more and more insistent and they develop leaders and break away from the parent organization. We are all familiar with this process.

Malignant Growths

Every organism has a dynamic gradient. This is dependent upon the fact that the controlling force at the head end is not sufficient to affect all parts of the body equally. When some irritation develops locally, it is like an insistent leader springing up in a group and adding enough energy so that the energy in that little faction is greater than the energy from the original controlling force. The local region may start off on an excursion of its own and develop an organization of its own. And that organization has in itself an objective out of harmony with the main organization, the larger organization, and it ordinarily destroys it. That is one reason why these malignant formations, like cancer, develop late in life.

Regressive Structure

Another interesting thing to which I wish to call attention is that whenever an organism undertakes to reproduce itself, the first thing that happens is that this highly complex organization begins to break down, and the organism drops back to the simple, undifferentiated condition in which it started off on life's journey. The hind end of the worm, for example, starts without a head, a tail, or any other distinct structure. It starts simply as a little broken off end of the worm, and then it begins a process of differentiation—head and eyes and then intestines and other organs begin to develop. When it in turn reproduces, all that differentiation breaks down and it all comes back to simplicity.

That is exactly what happens with us, and other higher animals, except in a somewhat different way. The germ cells, sperms and eggs, that we carry in our bodies are undifferentiated cells that have been separated out in the earliest stages of individual existence. When the embryo is progressively setting aside layers of cells that become respectively skin, muscles, bones, glands, and so on, there are groups of cells which remain simple in structure, undifferentiated. These cells eventually become reproductive cells.

Two Groups of Instincts

The organism manifests two types of instincts. First is the race-preservative instinct, or, as it is sometimes called, the sex instinct, or the instinct of reproduction, the life instinct, the instinct for life and immortality. The germ plasm that we all carry is handed on from generation to generation. We may die individually, but the germ plasm goes on for ever. It is millions of years old.

Then there is the group of so-called ego instincts, the instincts that make the individual develop along his individualistic lines, and make each individual different from every other individual. These instincts are the instincts that daily make for differentiation. When we die, it is not our germ plasm that dies, it is the structure that we have built upon the germ plasm that dies.

We might say that the undifferentiated cells that carry the germ plasm are the oldest part of us, and the individual characteristics that we have acquired in the course of our lifetime are the youngest part of us, while the things that we have acquired last, in the declining years of life, are the youngest of all. The undifferentiated cells really represent our oldest part. That has very interesting implications. It means that the death of the individual is a part of the differentiation process which, from the point of view of the race, means constant rejuvenation. The death of the individual is as important for the life of the race, as is the germ plasm itself.

Individual and Race

These individual differentiations are experiments that are thrown out like the branches of a tree. Ultimately they die off, having probably communicated something of the results of their experiment to the parent stem, but having left with the parent stem nothing that interferes with survival.

Take, for example, differences in race. Presumably differences of race are just like these individual differences that have been built up as side issues along these ever forward-going streams of germ plasm. We have questions raised from time to time as to the sup-

posed inferiority of certain races. We always like to think that whatever race we belong to is better than any other race, and so we like to think members of other races are not as good as we are. Naturally, they are inferior. But when we say that, we do not quite bear all of these things in mind. Perhaps the so-called inferior races are closer to the fundamentals than the so-called superior races from this point of view. Perhaps they are in a better position to pick up the modifications of present-day life which are of value or significance to humanity.

It is worth while to keep in mind the possibilities of the two great instincts, one eros, making for life, and one ego, making for death. The death instinct is the one that we follow as inevitably as the moth follows the flame because it means the aggrandizement of our own personality. We have, whether we will or not, ultimately to die, and by dying to contribute our individual share to the rejuvenation of the race, to the instinct of eros.

INSTINCT AND INTELLIGENCE

By CLAUDE A. CLAREMONT, B.Sc.

The principal difficulty which has hitherto stood in the way of a satisfactory definition of instinct is the heterogeneous nature of the material to which the term is commonly applied. One name for one class of things is the rule; and definition is then practical. But when the name covers several classes it is impossible to define it in terms of any one of them. Most people have a sufficiently definite idea of what they mean by intelligence to be able to say of any given action whether it is intelligent or not. Even if it be a border-line case, the fact that they can declare it to be such, shows that they have some criterion by which their judgment is guided. But whenever they meet something which is evidently not intelligence, they call it instinct; and this results in the formation for instinct of a heterogeneous class. Thus, we have grouped as instinctive the three following actions which are obviously quite different in nature: (1) the swimming of a water-bird when *first* placed in water; (2) the return of a homing-pigeon from a great distance; (3) the care of a bird for its young. Among laymen we even have a fourth class, that of acquired habit—" I instinctively felt for my latch-key," etc. Yet if other so-called instinctive actions be examined, we shall find ourselves able to place them with a fair amount of confidence with one or another of these types; showing that it *is possible* to form homogeneous groups within the class of actions commonly called instinctive. For example, the migration of birds will go with the return of the homing-pigeon, as seeming to imply a special 'sense of direction'. Or again, the awareness which creatures often show of impending climatic events, pheasants nesting low before a dry summer, and vice versa, would be placed in that group for a similar reason, namely, that they must indicate sensorial accuities unknown to us. We might call it a 'wisdom' group. But these actions are evidently quite different from a highly co-ordinated movement such as swimming, which may, it is true, be set off by their agency, or be utilized in their service, but which could not occur except by means of an elaborate muscular-neural mechanism of co-ordination which must

therefore pre-exist. Indeed, movements of this type merely differ from many of our own co-ordinated movements by appearing to be innate. They can really be classed with others that we make; breathing when we are born, coughing, sneezing, defecation, peristalsis, etc., all of which require the co-operation of many muscles, or muscular systems. Nature is evidently quite capable of producing co-ordinated movement without the process of learning, if she wishes. Indeed, it is difficult to see why such movements should ever have been called instinctive at all—except on the basis of a vague and not very sound comparison with ourselves. " Because we have to learn to swim, and the bird doesn't,—etc." It would surely be easier to get rid of these so-called ' instinctive ' movements altogether, by classing them with innate co-ordinated movements in general.

It will be convenient to note, at this point, that the only thing we have to go upon is action itself. When we see an action, the instinct or the intelligence behind it is merely inferred. The terms themselves have arisen merely from an observation of different types of action, and therefore it is to actions, and to the classification of actions, that we must go as a basis of definition. To define first, as so many writers do, and then apply this definition to actions, is to put the cart before the horse. It is also worth noting, as a point of elementary logic, that classification, based on a form of spontaneous recognition of differences, always precedes definition. Definition consists in discerning the essential features of a class of which we already find ourselves possessed. We do not (as a general rule) define first, and form the class afterwards. Men saw islands, and called each one an island, long before they said, " An island is a piece of land entirely surrounded by water." That this is the psychological mode of progression is proved over and over again by experience in the Montessori class. And if further proof be required, it will be found in the habit of writers who have put forward a definition, of testing it by considering whether such and such a specific case is covered by it. How can this be a test, unless the case examined is already known to belong to the class defined ? This was the method pursued by the late Dr. Rivers, in his ' all-or-none ' definition of instinct. I mention these things because, although elementary, they are nevertheless easily overlooked in a discussion of this kind, and it is necessary to keep them clearly in view.

It is true that a category may be formed by way of contrast, rather than by the recognition of similarities; and it is a case of this kind, apparently, with which we are dealing. Contrast, in fact, may well be (as early philosophers have suggested) the main-

spring of the whole thing. If you go into a lecture room where all the chairs are alike, it is probable that you will not see any of them—to the extent of noticing their type. But if half are of one kind, and half of another, you will notice both. Thus, it is because we see more than one type of action, that we notice both the intelligent type and others which are obviously not intelligent, to which we are obliged to give a different name. If this, indeed, be the origin of the two classes, we have an easy explanation of the reason why writers so commonly find it convenient to treat of intelligence and instinct in the same paper, the present being no exception. At the same time we shall be prepared for the fact illustrated here, and which can no doubt be asserted generally, that when two classes have arisen by contrast, it is probable that one will be fairly homogeneous, while the other is not.

Let us examine the so-called instinctive class more carefully. We see that the three divisions already noticed within it have the following mutual relationships. Innate reflex mechanisms, such as swimming, for example, may be used in a variety of ways. They may be employed, for instance, in actions which belong to one of the other groups. The water-fowl uses swimming as a means of finding food to bring back to her young. The homing-pigeon uses flying (an innate reflex—the bird *grows* to fly rather than *learns* to fly) in order to return to the nest. But why does she return? The *action of returning* belongs to the third group that we have mentioned, namely, the making of a nest, and the bringing-up of a family.

The sense of direction is similarly employed in the service of 'getting home'. The bird may, or may not, have such a sense; but unless there is some tendency for her to get home, she will not go. This same tendency to get home is operative when the bird is within eyeshot of her nest, and when the special sense of direction is either non-existent (as in some species), or not obliged to function. Again, we have a clear distinction between two things fundamentally different in kind. A desire to get somewhere, i.e. to be in some place, is not a 'sense of direction'; a sense of direction is not itself a desire to go, however intimately it may be associated with the 'touching-off' of such desire. Such a sense, if sense it be, functions like any other sense which waits, so to speak, upon the needs of an action. Thus, a complex action is directed towards an end, and certain senses play the part of controllers or checks upon the movement, indicating when it is wrong. We cannot even hold a hot-water bottle under the geyser-tap with our eyes shut. The eye is constantly needed to correct the muscular adjustments.

We cannot stand upright blindfold, if the sole of the foot be anæsthetized, or if we are deprived by disease of certain sensations from the semi-circular canals or from the muscles themselves. An artist wishes to paint a picture, and his senses guide him in the process, telling him whether or not he has succeeded. But these senses are not themselves his desire to paint. Others possess them who have no such desire.

Our third group of actions, therefore, is one in which the other two are found to be closely concerned, but which cannot be identified with them. We have, indeed, eliminated these other two groups from the sphere of instinct proper, by showing that they can be assimilated more easily to other existing categories, the one sensorial, the other motor. Because we are not ourselves possessed of precisely those movements, or aware of those particular sensations, we certainly cannot refuse the same names to phenomena so closely resembling those sensations and co-ordinations of which we *are* possessed. We are left, therefore, with our third group alone, and here, I believe, we shall find the required homogeneity.

The third group of actions may be described as involving indeterminate movements for a determinate end, and this alone is sufficient to distinguish them from reflex movements. It is not enough, however, to distinguish them from intelligent actions, which possess the same characteristic. It is here, therefore, that we experience the full force of the contrast, and its value. Let us take two actions, alike in all respects, except that one is universally regarded as instinctive, and the other as intelligent. The actions I will take are those of the hatching of eggs by a hen, and the incubation of eggs by a man. These actions have the same purpose, to hatch the eggs. Speaking scientifically the same means are used, keeping them warm. Where, then, lies the difference? Evidently it is a psychological difference. The difference, if discernible at all, is to be sought in consciousness (or in assumptions as to consciousness), and not in behaviour. Dr. Watson's psychology (if I understand his behaviorism correctly) would be obliged to regard them as identical. Nevertheless, no one does so regard them, not even, I trust, Dr. Watson. For one thing, it is not every man who would 'think' of incubating the eggs however much he might want them hatched; whereas no broody hen would fail to sit on them however little she desired, knew about, or was interested in, the outcome. We know this from experience, and no amount of reasoning, deliberate forgetfulness, or other mental manipulation, should be able to make us set on one side that experience. Hence there is a real difference between the man's mentality and the hen's; and, in fact, the real difference consists precisely in the fact

that the man has 'thought of' the plan of incubation, whereas the hen (we presume) has the right action thrust upon her in the form of a tendency, urge, or (if we permit her to experience conscious states similar to our own) *desire*. I say *we presume* all this, and that represents the true facts of the matter. For if we presumed the opposite, namely, that she knew the warming effects of sitting and so forth, and performed the action on those grounds as means consciously chosen to attain the end, we should immediately cease to regard the action as instinctive, and call it intelligent.

As our object is not to determine the psychology of hens, but what we ourselves mean by intelligence and instinct, any discussion here as to whether our assumptions in regard to her are correct, is beside the point. Certainly she behaves at this time in every way as if sitting on eggs were her sole desideratum. Fabre has shown by numerous experiments that it is very easy to trick an instinctive action out of its purpose, and that it is still performed when deprived of all *raison d'être*. We find a similar urge, indeed, throughout the whole range of instinctive action comprising our third group. The animal behaves as though in love with the *means* rather than the *end*. If we are in doubt as to the instinctive nature of such an action, we have but to ask ourselves (or try the experiment), "Would it be performed if the end were removed?" The man would not try to incubate china eggs; but the hen is known cheerfully to make the attempt. Many instinctive actions are performed by creatures who cannot conceivably foresee their result. Fabre gives wonderful instances in his studies of insect or larval life. Should we ourselves fall in love and cohabit, supposing no children were to come of the union? Yes. We often do. Then this behaviour is instinctive. It is not less so because we recognize the real purpose of the action. Should we (as at present constituted) eat, if we did not know that food were necessary to life? Yes. Then the taking of nourishment is instinctive. Should we, however, plough the fields and sow, if we did not know that a harvest would result? No. Then ploughing and sowing are not instinctive.

The invariable rule is that instinctive actions are means to ends, but it is the means themselves that are sought after (in our experience, desired, beloved). We have the curious spectacle of an individual acting for an end, but the end is not his end. His end is the means! He is really a servant, but an unwitting servant, of something other than himself. The end, we might say, is the end of the creator, not of the creature.

Intelligent actions, also, are directed towards an end. Ploughing, sowing, and harvesting are means of obtaining food. But here the

means are chosen by the performer *after he recognizes their relation to the end.* We have here, therefore, a factor which is not present in the instinctive action. And we also notice that the *point of desire* has shifted. Now it is the end which is desired, and not the means. Both these points are worthy of attention, and I will take them separately.

First, the relationship of means to ends. *This is always causal in type. Hence the intelligent action must always contain an awareness of causal relationship.* I have tried to show elsewhere[1] that this conception is of very wide application; in my view, indeed, the whole intelligence problem gives way before it.

Our second point is the *shift in desire.* The individual is looking, as it were, further ahead. Let us take a very long chain of actions or a cycle of actions, such as is needed to perpetuate the race. Many actual illustrations will come to mind; but I will generalize, calling them A, B, C, D, etc., and represent them diagrammatically by a chain of points. Now, instinctive actions will differ from intelligent, according as these actions are desired and performed each in turn for their own sake as ends in themselves, or as they are seen as means to a distant end which is desired, and are carried out merely in order to achieve it. A hypothetical creature, for instance, which made itself clothes because it wished (1) to cut out, (2) to sew together, (3) to wear clothes, would be instinctive.[2] A creature which made clothes to keep warm would be intelligent. Thus the more intelligent action is performed for the sake of a point further ahead. Yet it is merely a question of degree. A point always comes beyond which the doer is not looking. In human psychology a man ploughs, sows, and reaps in order that he may eat. But he eats for eating's sake, and would do so were no further ends gained by that act. Even if he works that his family may eat, we come again to an instinctive end, the good of his family. Beyond that he is not concerned. But are there really no points beyond that? Assuredly there are. His family concerns posterity. There are points ranging indefinitely ahead. Doubtless he is really working for those, but he does not know it. Like the lowliest insect, his range of desire is circumscribed. He works for an end, but that end is itself a means.

A diagram showing the ' jumps in desire ' for an instinctive chain of actions, as opposed to an intelligent one, will therefore read like this. The loops are drawn from points to points which constitute ' ends ' for the doer.

[1] "The Problem of Intelligence" *Psyche*, Jan. and April, 1926.

[2] Many chains of insect-behaviour, recounted by Fabre, are no less remarkable.

PURELY INSTINCTIVE

A B C D

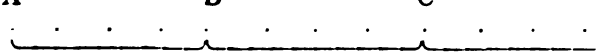
INTELLIGENT

A B C D

The more intelligent the individual the longer are the loops—the more intermediate actions may be performed which are not for him ends in themselves, but means to his ends. (We do not say these intermediate 'means' are not, or may not be, 'desired', i.e. provide the occasion for emotional states; but they are desired merely as means to an end, and not as ends in themselves. The young man engaged to be married will regard the requisite economic means with an emotional intensity borrowed from the end in view; and all collapses, for example, if his love dies.) Another, and most important, characteristic of these intermediate means, as opposed to the individual's ends, is that they are variable, adjustable to circumstances, and therefore, also, *improvable*. The primitive savage clubs his prey. The more advanced savage makes bows and arrows to shoot. Nowadays we have factories to make guns, and so on. *The ends of action, however, are fixed.* The loops in our diagram go from fixed point to fixed point; and *these points are characteristic for the species.*

And now comes a further interesting corollary. Between every two fixed points there is *always* an indeterminate interval. The bird first hatches her eggs. Let us call this, fixed point A. They hatch, and immediately fixed point B heaves in view. The bird's desire to sit is replaced by a new one, to feed the nestlings. Later she will turn them out of the nest, then migrate, and so on. These are the fixed points of her cycle. But let us examine her movements in between any two of these fixed points. They are indeterminate; capable of conforming to circumstances. In feeding her young, prey may be found far or near. She seeks it out, making journeys of longer or shorter duration, and varying in direction. While building her nest, another fixed action, she will make use of this or that type of building material. In short, the result only is fixed; the means are for her to find. What are all these indeterminate intermediate actions? We could place dots in our diagram to represent them—dots between A and B, for example. And then we should have in miniature our second diagram reproduced. But that is a diagram for intelligence!

A B C



Are we, then, to consider the bird as intelligent in these intermediate actions? Why not? Does she not know that these actions contribute to her end? A piece of wool is as soft as a piece of moss. Why should she take the wool—which no member of her race may ever have seen before—unless she relates it to her end? Fabre calls this characteristic of the lower creatures 'discernment'. I do not see that it differs in kind from what I have been driven to call intelligence—an understanding, however elementary, of the relationship of cause to effect. When a bird building its nest 'sees' that this twig must poke under that in order to hold, are we to deny to her that power of recognizing causal relationships which children show when they 'see' that a Montessori inset can only fit *exactly* into a socket of corresponding shape? No doubt the power is very specialized in the bird. She could make nothing of the inset. The child might recognize the relationships in the nest as well as those of the insets. But a realization of spatial inter-connections cannot be ruled out (as McDougall has recently insisted) from the behaviour of even lower mentalities than the bird's. We are approaching Bergson's conception of the fusion of instinct and intelligence in all types; but we are making it more clear. I would not care to be dogmatic about it. These last views are purely suggestive. What appears to me undoubted, and what we may now assert, I think, without fear of contradiction, is that between the fixed points *there is room* for intelligent action. Indeed, it is between the ends determined by instinct that intelligence must always lie; and my suggestion is that this picture we have formed can be extended in either direction, remaining constantly in accordance with the facts. True, as we approach the extremes of instinct, the points will come closer together, less and less is left indeterminate; but indeterminate actions *made for a purpose* can never entirely lose that essential quality (though it be of vanishing quantity) that we have regarded as characteristic of intelligence.

CHRONAXY

IN RELATION TO

IMPULSE, INHIBITION, AND THE CONDITIONED REFLEX

By C. K. OGDEN

The body is a vast society of living cells, many hundreds of thousands of millions in number; each of these cells has its special task, its contribution towards the activity of the whole society. Each, of whatever kind it may be, in skin or bone or muscle or gland, depends for its life upon the co-operation in numberless ways of other kinds of cells. But this co-operation does not come about of itself. Special arrangements are needed to adjust the different activities of separate groups of cells to one another; and, what is equally important, to put the organism as a whole into adjustment with what is happening outside it. From minute to minute the situation in which we find ourselves changes; we need to make suitable corresponding changes ourselves. Conversely, our own internal state changes and we need to make suitable changes in the situation. The principal agent whereby this is done is the nervous system.

The nervous system is itself made up of living cells which specialize as conductors, handing on disturbances which arise in one part of the body so that other parts of the body can deal with the situation. These cells (known as neurones) are of a fantastic variety of forms, but since they are all essentially conductors, they have a common plan. Each consists of a cell-body and also of a varying number of prolongations, in some cases of great length. When a stimulus is applied to one portion of the neurone a wave of change spreads through it at considerable speed (in man as high as 125 metres a second). This wave of change is handed on from neurone to neurone; they touch one another off as a series of fuses in contact might.

The point to notice is that there is always a bewildering variety

of possible paths for the impulse, and which of them it takes is the all-important matter, since different paths lead to different responses and so to different behaviour and different experiences. It may be added that, however incomplete the physiologist's account of what happens at the synapse, the psychologist's own independent account of choice (for this is what is often psychologically in question) is just as scrappy and unfinished.

The central problem is this, How does it happen that an impulse takes one path on a given occasion and not another ? The central part of the nervous system (the spinal cord, that is to say, and the brain) is an arrangement for adjusting precedences between various claims in view of the whole relevant situation. The motor neurone, or the similar apparatus in the case of a gland, is sometimes called the ' final common path'. It is an apparatus at the disposal of an immense number of impulses from different sources, some of which can use it together while others obviously can only use it in turn. In between the sources of these impulses and the motor apparatus intervene tier after tier of clearing-houses sorting out rival claims, combining some, holding up others. These are arranged in tiers because plainly the extent of the relevant situation varies from case to case; it may be comparatively narrow and simple, or it may embrace the whole nature of the universe as known to the individual. The situation relevant to the way we breathe, for example, is fairly simple. The main factors are the state of the atmosphere and of the blood and the position of the body. So the adjustment of the various claims can ordinarily be left to fairly lowly centres as a routine business. But for the singer and the Everest climber the matter is more complicated; higher-level clearing-houses have to take charge, and since these higher centres are less used to the business, a learning process is required.

The Importance of the Head

The highest centres are those which have to take note of the widest and most intricate situations and to order the largest and most varied sets of claims. For reasons which are clear enough in outline they lie in the head—in the cerebrum and cerebellum. To quote Professor Sherrington :—

" The head is in many ways the individual's greater part. It is the more so the higher the individual stands in the animal scale. It has the mouth, it takes in the food, including water and air, it has the main receptive organs providing data for the rapid and accurate adjustment of the animal to time and space. To it the trunk, an elongated motor organ with a share of the digestive surface, and the skin, is appended as an apparatus of locomotion

and nutrition. The latter must of necessity lie at the command of the greater receptor organs of the head."[1]

The nose for lower animals, such as the dog, the eyes and ears for man, are the sources of most of the claims which are going to be made upon the motor neurones that finally promote action. And the dominance of the brain, the organ for co-ordinating the impulses set going through these sense organs with the rest of the impulses ceaselessly flowing through the nervous system, is explained by this fact.

The Spinal Cord

The exact way in which neurones interact is still largely a matter of speculation. What little we know of them comes chiefly from experiments upon what are known as 'spinal' reflexes. When the spinal cord is severed from the brain its operations are no longer controlled by the higher clearing-houses, and a great simplification results; further, as there is clear evidence to show, consciousness, including pain, for the parts thus cut off, no longer occurs. It is then possible to elicit movements, say of the leg, by simple stimuli in a very uniform manner. By combining stimuli and noting the responses, something of the ways in which impulses combine or interfere with one another can be made out. For instance, as most children know, there is a scratch-reflex which can be elicited in a sleeping dog by gently pulling the hair or tickling the skin of his flank near the shoulder. Now there is a curious point which even experiments on the hearth-rug will bring out. The scratch has a rhythm of its own. It varies in vigour and in the amplitude of its sweep, but remains almost exactly the same in rate, however we space our ticklings; whether *we* scratch the dog slowly or rapidly, he scratches himself at a uniform rate. The responses are spaced out as compared with the stimuli by a central arrangement which completely transforms the rhythm of the impulses. The reason is evident; if it were not so, the leg might merely reach the point to be scratched and stay there. It must have time to return to the starting point.

Inhibition

But this return is really a complicated affair. The leg is moved by two sets of muscles opposite to each other. One set bends it, the other stretches it. When the leg is at rest both these sets are mildly active; each has a slight contraction which is known as the muscular tonus, and this is, in part at least, maintained through

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[1] Sherrington, *The Integrative Action of the Nervous System* (1914), p. 350.

a series of impulses continually passing out through the motor neurones. When the leg is bent one set of muscles (the flexors) contracts more vigorously; the opposite set (the extensors) relaxes. So in every movement the motor neurones concerned have to see that one set of muscles contracts and the opposite set relaxes. In other words, introducing an important technical term for an idea which is fundamental in psychology, one set of muscles is excited and the other set is *inhibited*. Actually, the problem is less simple, for it has recently been claimed that voluntary muscles are innervated from the sympathetic nervous system as well as by the cerebrospinal.

It is tempting to suppose that there must be a special set of motor neurones or a special kind of impulse whose office is solely to inhibit. But the very same motor neurones are used sometimes to excite a muscle and sometimes to inhibit it. Inhibition is a shutting off of excitation from the motor neurones, not a special form of message which immobilizes the muscle. Excitation is a passing through, inhibition a cutting off, of impulses. As the dog scratches away, at every stroke spinal impulses are being turned *on* for the flexor muscles and *off* for the extensors and vice versa as the leg sweeps back. What, in terms of inter-neurone action in the spinal cord, is happening?

The part played by inhibition throughout the working of the nervous system is so extensive, and its importance for psychology is so great, that any approach towards an understanding of it is of value.

The most recent theory, due to Lapicque, is as speculative as the other theories which have been advanced, but it has the advantages that it is closer to the probable facts and is more helpful in imagining the subtler happenings in the nervous system than some of the others. It starts from comparing the times required to produce a response in different nerves and their muscles. The way in which it has been worked out is as follows.

Chronaxies

There is for each muscle and nerve a certain intensity of electrical stimulation which is the least that will excite a response, however long we give it. If this intensity is doubled and the times these doubled intensities take to excite the nerve or the muscle are measured, it is found that these times (known as 'chronaxies'—from *chronos*='time' and *axia*='value') have simple relations to one another. Every tissue has, as it were, its own private time-value.

For example, a muscle and its motor nerve have the same chron-

axy; they are isochronous, but different muscles have different chronaxies. Neurones, too, have each their own chronaxy. When the chronaxies of neurones which work together are not the same, one is an integral number of times longer than the other—three times for instance. Now—and this is the interesting point—it is found that conduction only takes place when this normal relation between chronaxies holds. By poisoning a nerve, with strychnine or curare, for example, we can alter its chronaxy and then the excitation no longer passes to the muscle. It is the *difference* between their chronaxies which matters. If we lengthen or shorten both the chronaxies together, the conduction still goes on; it is only when we alter one without altering the other that it ceases. And similarly with the neurones. They get out of tune, as it were. The expression is not strictly correct since a change in chronaxy is very different from a change in a rate of vibration, but we shall use it for lack of a better and say two neurones are *in tune* when their chronaxies allow the impulse to pass, and out of tune when they don't.

Inhibition, then, might consist in a change of chronaxy throwing an afferent neurone and a motor neurone, for example, out of tune with each other. This would be a delightfully simple solution of the problem. And fortunately there seems good reason to accept it, for it has been shown that changes in chronaxy can be produced not only by poisons, by fatigue, and by hormones such as adrenalin, but by neural influences themselves. Cutting off the action of the brain commonly doubles the chronaxies in the spinal cord. Now this seems to imply that neurones, besides handing on impulses, have a further, quite distinct, way of influencing one another. If this is confirmed it opens a completely new prospect of explaining thought in terms of the brain.

In what follows we shall call the passage of trains of discharges 'impulses' and modifications of chronaxies 'influences'. A neurone can be discharged by other neurones and it can be influenced, tuned up or tuned down, by them. This last, and especially the possibility of its being tuned back again to its former chronaxy, is all important, as we shall see later. One further point should be noticed. A given difference from the normal tuning may stop a moderately strong impulse from passing, but a stronger will get by. Thus the normal channel for an impulse may be overflowed if the excitation is violent. This helps to explain why different intensities of stimulation may have such different effects; and, we may add, it is of great significance in connection with emotion.

Higher and Lower Levels

We may now consider how the various higher and lower level clearing-houses in the nervous system are related. And we must be careful not to choose a point of view which presents the matter upside down, so to speak. Since the arrangements in the spinal cord are more easily investigated than the higher centres in the brain, it is easy to fall into the habit of thinking of them first and regarding the brain as something which they call into action only if they cannot get on without it. But if we want to understand a business it is better to begin by talking to the directors than by plaguing the office boy and the stenographers. We may otherwise tend to see the superior authorities merely as conveniences which the lower ranks call in only when they need them. But in fact it is the other way round.

Instead, then, of starting with one particular stimulus and asking how it comes to arouse a particular response, we must begin, as psychologists, with the total situation in which the body finds itself. Of the innumerable impulses which are coming in from the greater number of our sense organs all the while, only a small proportion ultimately reach the final common paths, the motor neurones which excite the muscles. But very many which themselves play no final part have yet, at one level or another, a say in what finally shall take place; typically by barring out other impulses which otherwise would get through. And only a small proportion of these finally give rise to consciousness in the form of mediating the individual's *awareness* of some part of the situation. A process of selection takes place quite early in the afferent (incoming) course of the impulse. Further, a set of excitations which in themselves would each be unnoticed and have no central effects may, if they happen to come together in a certain pattern, get through and take effect at once; for example, a set of black and yellow streaks in the landscape when, and only when, coiled upon one another in the rattlesnake fashion, or a set of sounds in an otherwise unnoticed hubbub if they happen to be arranged in the pattern of our own name.

Receptive Centres

Thus the notion of *receptive centres* which act as a kind of selective sieve becomes necessary; and the actual location of some of these centres in the cerebral cortex has been discovered. Here a preliminary sorting out occurs. For example, other things being equal, a stimulus which is unlike its neighbours has a better chance of getting through, and certain kinds of impulses have almost invariable

precedence. Again, impulses arising from stimuli harmful to the skin override all others. But hard upon this simpler kind of sorting out there follows a more complicated task—that of responding to certain patterns, as with the snake or the name, and not to others. The reception apparatus recognizes some patterns just as a lock 'recognizes' its key. It is not difficult to imagine this being done by a system of neurones which discharge other systems only when excited together or in a certain order.

Co-ordination Centres

The receptive centres are in close connection then with *sensory co-ordination centres*, as these arrangements which pick out patterns among incoming impulses are called. Certain injuries, it is found, may incapacitate the co-ordination centres without disturbing the receptive centres. In such a case there might be nothing detectibly wrong with the patient's vision, for example, in itself; he would not be blind, he would merely not recognize anything he saw.

But the different co-ordination centres are themselves in close touch with one another, as we see if we shut our eyes and attempt to recognize an unfamiliar object first by touch and handling alone, and then with our eyes open. The particular patterns which one centre will pick out depend upon the patterns which other centres are picking out or have just picked out. How is this interdependence brought about?

Association Areas

There is here probably the same kind of rivalry for a common path (not in this case, of course, a *final* common path) that we encountered in the case of the motor neurones of the spinal cord. The various receptive areas in the brain are known to be linked together by tracts of nerve fibres in a very intimate manner; impulses leaving each are continually passing onwards a further stage towards their goal, the motor neurones. But they have a long way to go, many alliances to make and many competitors to deal with. Thus on the inner side of the sensory co-ordination centres there will be many further centres which carry out the same kind of transactions as the co-ordination centres; only this time with the products of the co-ordination centres and not with original impulses from the sense organs. We may call these higher clearing-houses the *association areas*.

Now imagine a co-ordination centre which has received from the receptive centres let us say 7,003 impulses which together make up a certain pattern, and suppose that it hands on a much simplified pattern of 42 impulses as the result of the combined action of these

7,003. This 42 pattern is a candidate for passage through an association centre. But at the entrance it has to pass through a set of neurones which are also being used by other patterns coming from other co-ordination centres. Suppose that it conflicts with them, that it cannot make an alliance and reinforce them, but is in some way incompatible. The situation will be similar to that which we have already considered in the case of the spinal reflexes. What will happen?

Evidently there is a bewildering number of possibilities. There may be other association centres into which it *can* discharge, so getting round the difficulty for the moment. But then the problem is shifted on to a yet higher association centre in which the claims of the lower centres are adjusted. It may be that part of the pattern can get through and part not. It may be that it will as a whole supersede the other patterns and bar them out, or it may be barred out itself. In the last case the barring out may be permanent or temporary, and this will depend upon the degree of insistence of the pattern, a matter which we have yet to consider.

The most illuminating case, however, is that in which it is possible for the co-ordination centre to pick out from its 7,003 impulses and send forward a *different* pattern which *can* combine with the others and get through the association centre. Endless instances from perception suggest that this is what ordinarily happens. Whenever we first suppose ourselves to be perceiving one thing and then, since other sensory evidence makes this impossible, detect that we were mistaken, we have such a case. The interesting point is that then the thing, whatever it is, *commonly looks* quite different from what we supposed it to be. In such cases the co-ordination centres seem plainly to try again under a subsequent influence from the association centres. We need not suppose, however, that this subsequent influence actually goes through the same neurones which brought in the rejected pattern.

Expectation

So far we have been tracing the march of the armies of impulses inwards, but by the time the association centres are in play there must be corresponding movements outwards, from higher centres to lower, from association centres to sensory co-ordination centres. The influence of expectation on perception is clear evidence for this. If we are expecting a certain person to appear in the distance we are extremely likely to mistake other people for her. Now an expectation in such a case involves a special setting of a co-ordination centre brought about by an association centre, a certain preparedness to pick out one pattern rather than others. What

we know from within as ' attention ' is accompanied by a heightening of tone. An impulse or influence from above alters the lock—to use our former metaphor—so that the 7,003 impulses coming in from the receptive centre may more easily turn it.

We must think, then, of these tides of impulses as having eddies, through which what has already reached the centres controls what is still coming in. There will be circuits of this kind not only from association centres to co-ordination centres but from higher to lower association centres. A typical case is the influence exercised by a general conception (which is the activity of an association centre of relatively high level) upon the particular instances of experience which can be brought under it. When we know that a thunderstorm is an electrical phenomenon, it is no longer quite so easy to regard it as a judgment upon our actions. Even the most intricate intellectual play of ideas—the mastering of a psychological theory, for example—may be imagined as consisting of the same kind of transactions as those of the co-ordination centres and the reflex centres of the spinal cord, but carried out at higher levels and perhaps of even greater complexity.

The Influence of the Past

In one respect which has not yet been mentioned the complexity is certainly greater. The higher we go in the nervous system the more definite and the more subtle the influence of the past becomes. The spinal dog shows no signs of personal memory. Its reactions are fixed. It can be taught nothing. But in the intact dog, more in the ape, and still more in man, reactions are not fixed. What happened in even the remote past of the individual's history has its bearing upon what happens now.

What exactly memory may be in terms of the nervous system is a problem which is still a very long way from solution. It is better perhaps to speak of *retention* than memory, for memory may mean either recollection (I have a memory of Armistice Day) or that I now can do something (e.g. swim) which I could not do if I had not done it before. The second is the sense in which retention is used. The first (recollection) is a special instance of the working of retention. Both offer many problems some of which we must now briefly consider.

Retention is already active at the level of the sensory co-ordination centres; it is essentially a matter of the repetition of certain co-ordinations even when the circumstances are no longer the same. It shows itself in two ways at every stage of co-ordination right up to the highest levels.

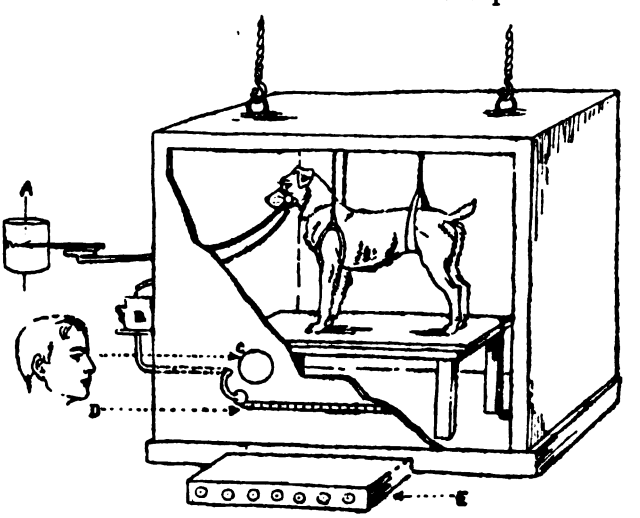
Retention and the Conditioned Reflex

The response on repetition may become quicker, smoother, more perfect of its kind, as we see happening in the formation of *habits ;*

or it may dispense with some part of the stimulation which was originally necessary, as we see most clearly in the formation of what are known as *conditioned* reflexes. Usually the two effects of retentiveness go together.

When two impulses have co-operated to produce a certain response it is found that after a sufficient number of repetitions one of them alone may bring it about, though formerly inadequate by itself. Such a response is said to be 'conditioned'; a new stimulus has been substituted for the old, and the response now occurs under new conditions. In man very few repetitions may be sufficient; but after infancy all his reactions are made to such complicated situations that it is far easier to study conditioned responses in animals. Even here, however, the most elaborate precautions are required to exclude disturbing factors.

The fundamental work on this subject has been done by Pavlov and his assistants at Leningrad, and the results already attained seem likely to be of the utmost assistance to psychology. They are the foundation of the theories of the Behaviorist School. Pavlov has found it best to work with one particular response. A dog secretes saliva when given food. It is his first step towards digesting it. Now all through the evolution of the dog (the same is true of man) he has been constantly on the lookout for signs of food. He is thus specially prepared for all kinds of different stimuli to become connected in his association centres with the presence of food.



PAVLOV'S DOG

A. Revolving drum for recording rate of secretion of saliva
B. Vessel for receiving salivary secretion
C. Observation window or periscope for observing dog
D. Graduated scale for measuring quantity of salivary secretion
E. Electric contacts for setting into operation source of stimulus

This gives the investigator his opportunity. Every time food is put before the dog a particular note, for example, is sounded. After a certain number of repetitions of this combination the note is sounded alone. The dog's mouth waters. A conditioned reflex has been established. It may be added that the dog does not seem to be averse to this experiment, and jumps of his own accord on to the table where he appears in our illustration.

By this method many very remarkable phenomena have been brought to light. For example, at first the conditioned stimulus (the note in the case we have taken) irradiates. By this it is meant that any similar stimulus produces some degree of salivation. But as the conditioned reflex becomes more and more established this irradiation is narrowed down until only notes very similar indeed to the conditioned note share its power of evoking the reflex. If such a note is now sounded repeatedly *without* the unconditioned stimulus (the food) it soon becomes 'inactive'; it loses this power. It has been shown that this loss is not a mere disuse, but an actual inhibition. The 'inactive' stimulus inhibits salivation. One fact which shows this clearly is very striking for further reasons. Suppose that just before or during the elicitation of a conditioned reflex we give the dog a strong extra stimulus which has not been conditioned in any way, the conditioned reflex is at once greatly reduced. This new external inhibiting activity superimposes itself on whatever process it encounters. If it meets with excitation it inhibits it; but, and here is the surprising fact, if it meets with inhibition it *inhibits this inhibition*. Thus an electric shock just before the sounding of a note which has been made 'inactive' causes this note to be no longer inhibitory and salivation reappears.

By progressively making notes nearer and nearer to the conditioned note 'inactive' it is possible to investigate the dog's powers of *discrimination*. With pure tones it is found to be vastly superior to that of the best human musicians. A point of interest to educators arises with what is known as conditioned inhibition. In this case the conditioned stimulus is accompanied by some slight indifferent stimulus—not, as in the last case, by a strong stimulus which itself causes an unconditioned reflex. After a number of repetitions the extra stimulus causes inhibition, and this increases; in the former case the inhibition grows weaker. It is found that well-established discriminations are temporarily interfered with during the development of such conditioned inhibitions even when they concern quite different kinds of stimuli. But as soon as the new acquisition is firmly established, the interference ceases and the discrimination returns to its former state.[1] This

[1] G. V. Anrep, *Proc. Royal Soc.*, Series B, vol. iv, pp. 404 ff.

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phenomenon is met with constantly in education. As Anrep remarks, a child who, having mastered addition, is taught multiplication, will for a while make mistakes in addition. A dog which had failed to develop a discrimination did so almost at once after an easier conditioned inhibition had been acquired. The moral is perhaps that a child who fails at a problem will have a much better chance of solving it after a successful spell at an easier task.

Finally the extraordinary facts of experimental neurasthenia in dogs should be mentioned. If the dog is persistently given too difficult a task, for example if he is forced to attempt a discrimination between shapes which are too similar for him, he little by little loses all his previously acquired conditioned reflexes. He even fails in the end to discriminate between what is edible and what is not. At the same time he becomes quarrelsome, dirty, and unmanageable, howls at the moon, and finally ends up in a state of general incompetence. A prolonged rest cure at a farm is needed to restore him to his former good-tempered sanity. The general bearing of these results, when they are explained, upon human psychology is likely to be immense. But we must return to the problem presented by the simplest case of conditioning.

The point to note is that here we have a response, the watering of the dog's mouth, which would not have occurred if the conditioned stimulus (the note) and the unconditioned stimulus (the food) had not been combined in the comparatively remote past. The past conjunction has left some effect in the dog's nervous system through which the note alone produces the response which formerly required the presence of the food. How are we to conceive this effect ?

The Image Theory

It is important not to think of it either as the storing in some neural archive of an image of food which bobs up to co-operate when the note is sounded, or as a mere track gouged out, or a channel in the neural pathways deepened or enlarged. Both theories have tempted many psychologists and both are unsatisfactory. The objections to the image theory are simple. There may be an image formed; but if so (and the point is very difficult to settle) it would be something itself needing explanation and could not be used *as* an explanation. And, further, images are *not* stored up; they are *not* persistent effects. They depend upon persistent effects, but the old theory that they themselves reside permanently in cells in the brain is long ago exploded. An image is a process, a transaction, just as much as a perception; it is a happening. And there is every reason to suppose that images differ only from the actual

experiences by being aroused not through incoming impulses from the receptive centres but through impulses of central origin, We call them images because they correspond to perceptions. and they are due in some way to persistent effects left behind by perceptions, but they are not, themselves, those effects. What lasts is not the image, but as Hering said, " the peculiar attunement (*Stimmung*) of the nervous substance in virtue of which it will give out to-day the same note that it gave out yesterday, if the strings be touched aright." The problem of the image is in part the same problem as that of the conditioned reflex itself. Namely, what is the nature of the residual effect? But the conditioned reflex is more easy to investigate, and should be considered first.

The Theory of Lowered Resistance

The other explanation in terms of a deepening of nervous channels is much more on the right lines. But it is plainly not enough to suppose merely that the repeated passage of an impulse lowers the resistance of the synapses; and for the following reason. In come the two impulses, due to the note and to the food, close together. The note must be sounded before or contemporaneously with the giving of the food; otherwise the conditioned reflex is not established. No conditioning at all takes place, surprisingly enough, if the note be sounded after the food is given. After a number of these combined arrivals the note-impulse arrives alone and now goes through in the absence of its formerly indispensable colleague. It plainly will not do to say merely that the final common path (its entrance resistances having been lowered) has now got used to this particular intruder. If henceforth it always got through, that might be a possible account. But, in fact, if we go on sounding the note without the food, the salivation instead of becoming more and more copious, soon ceases altogether. The mere passage of the impulse does *not* of itself keep the resistance down; actual conjunction from time to time with the other impulse, from the food, is necessary.

But, it may be suggested, is it not sufficient to say that the two together lower the resistance to the one alone for a certain while? If I have no money and a friend goes with me occasionally to the opera and every time buys me a seat for the rest of the week, do we not have a situation somewhat like the conditioned reflex? If I begin by going alone my appeals have no effect on the box office; I do not get through. With my friend I do get through, and I get through afterwards for a limited while only, unless he comes again—when my privilege gets a new lease of life. The objection to this analogy as throwing any light upon the conditioned reflex is, however, that the proceedings in the box office are themselves also conditioned

reflexes on a more elaborate scale, and just as much in need of explanation as the watering of the dog's mouth. It may be remarked that circular arguments and analogies of this kind are extremely hard to avoid in psychology. All the comparisons which are so popular between the nervous and the telephone systems are guilty of it in more or less serious degree.

Success as Establishing Attunement

But to abandon the theory of lowered resistance is not in the least to give up hope of a physiological explanation. Let us see what can be done with the aid of the tuning or chronaxy theory. We must remember that the problem is not properly set if we merely ask how do the note-impulse and the food-impulse arrange affairs between them as regards the salivary discharge, and neglect the rest of the dog's impulses, notably those which would be modified if he had just gorged to repletion.

Neither the impulses from the note nor those from the food come into an indifferent brain. The latter find a centre already tuned for them by the emptiness of the dog's viscera. The impulses from the note reach this centre—and they must reach many other centres besides. The fact to be explained is that after a certain number of conjunctions in this centre with the food-impulses, the centre discharges on the arrival of the note-impulses alone. We must remember that practically any stimulus in place of a note can be conditioned in the same fashion. Even a painful stimulus can. All symptoms of fright or pain cease and a severe pinch or bruise merely causes abundant salivation. Nothing brings out the interdependence of the processes in the brain better than this astonishing fact. Whatever sensory stimulus—whether from a colour, a noise, a touch, an electric shock, or what not—immediately precedes the giving of the food, the impulse it arouses comes to discharge the centre in place of the food-impulse, given sufficient repetition.

The difficulty of understanding how this happens is due to thinking of the centre in two phases only—as it is when the note-impulse reaches it, and as it is when the food-impulse causes it to discharge. Instead, we must think of it in four phases:—

(1) as it is when played upon by hunger-impulses before the note-impulse comes in,

(2) as it is when this impulse has altered it,

(3) as it is when the food-impulse discharges it,

(4) as it is when the consequences of the arrival of the food in the stomach are playing upon it.

This last seems to be the decisive phase in tuning the centre to discharge henceforward on the mere arrival of the note-impulse. Evidently the food- and note-impulses together leave the neurones of the centre in a peculiar state of tuning which lasts for a little while. The incoming of the impulses from the stomach fixes this state. Next time the note-impulse comes in it finds the centre still tuned in the same way—tuned, that is, to be discharged either by the note or by the food, and the centre discharges. As to how this particular tuning comes about, the simplest hypothesis is to suppose that the simultaneous or closely successive activity of two neurones in the centre brings their chronaxies nearer together, so that next time, if this change is fixed, the one can now discharge the other. A number of steps may be needed for this approximation. Thus, in the dog, twenty or thirty may be required, and in the rat a much greater number. In man it can often be achieved at one stroke. Similarly, the time the fixation lasts varies greatly. In the dog, if we do not give him the note too often without the food, or otherwise bring in inhibitions, it lasts indefinitely, as it does in man. In the cockroach it seems to last at most half an hour. The memory of the cockroach is not very tenacious.

We can now see how it is that if we sound the note too often without food, we break down the conditioned reflex. The tides of impulses (phase 4) which come to the centre after salivation, from an empty stomach or a full, are very different; the tuning there, instead of being fixed, is changed. The note henceforth, instead of exciting the final common path now inhibits it.

We have lingered somewhat over these intricacies, as we did over the theories of inhibition, so that the reader may take stock of the difficulties; and also that he may realize why the physiological explanation of the brain's activities does not stand or fall with the success or failure of any one particular theory. There is still much work to be done in the physiological laboratory whose results will undoubtedly have a direct bearing on these problems. The main attack has not yet been made. The work so far done amounts to ' getting the guns into position ' for that attack. So that to assume special ' psychical ' agents, or to maintain that the working of the mind is beyond the scope of any possible physiological explanation would be a rash procedure for a psychologist to-day.

THE HEROIC ROLE

AN HISTORICAL RETROSPECT[1]

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History is evolution in its mental aspect. The records contained in the ancient inscriptions of Egyptian or Mayan monoliths are as truly a process of archæology as the prehistoric stones in which they are written. Historic processes, however, as they relate to man embody man's own reflection of himself. Through them he is given back to us in the mirror of his own thought. To understand the thought of man, the historic mirror in which his thought is reflected must be understood also.

A scientific estimate, then, of historic processes calls for an analysis of the mental factors entering into them. We know that the story of the race, as the story of the individual, is coloured by the personal interpretations of the story-teller. But in a comprehensive view of the materials of history we need reckon not only with the individual bias that animates the personal interpretations of the historian, but also with the reciprocal bias that is presented in the social reactions of his listeners. So that an exact evaluation of historic data requires not only that we discount the element of private prejudice that inheres in all human narrative, but that we recognize this subtly animating quality to be a social as well as a personal condition of all historic evidence.

The outstanding heroes of history have been represented in the two contrasting extremes of saint and soldier. Upon the one hand stand Buddha, Christ, Assisi; on the other, Alexander, Cæsar, Napoleon. The power of the one lay in his meekness, self-subservience, renunciation; of the other in his will to aggression, domination, self-aggrandizement. The saint speaks dreamily of a kingdom not of this earth, that may be conquered through prayer and fasting

[1] Read before the Section of Historical and Cultural Medicine of the New York Academy of Medicine, March 26, 1925.

and through lowliness of spirit; the soldier acclaims a kingdom here and now to be conquered through recourse to might, violence, and depredation. The one inclines toward individual isolation and retirement; the other toward wide social acquisitions and personal pre-eminence. The soldier achieves glory in causing the death of others; the saint achieves glory by bringing about his own death.

With saint and soldier, however, there is a characteristic that is common to both. Each in his mental outlook envisages a world divided between good and evil. Each feels that his cause is right and meritorious as against an opposing element that is unrighteous and ill. Over this divided cosmogony the hero, whether saint or soldier, feels that it is his special privilege to preside. It is characteristic of the saint that he meets his divided world with the maternal attitude of patience and solicitude. It is characteristic of the soldier that he meets the same world with the more active intervention of paternal domination. But each identifies himself with a cause he feels to be right. The one fights and schemes for its triumph, the other fasts and prays to the same end. The one presents toward life the countenance we associate with the more feminine mode of adaptation, the other offers a mode of reaction that is more habitual to the masculine rôle. But the characterological mark that is of pre-eminent significance in both saint and soldier is the assumption by each that he has a special call to reform a world that is in need of his ministrations. Each takes the position of an agent appointed to minister as protector and guide to a world that exists outside himself. In his assumed prerogative each stands off mentally from his environment and prescribes a course leading to its betterment. In this attitude each erects an *image* of himself, and by virtue of the rôle he assumes under this image we designate him the hero.

In an analytic study of consciousness, to which the way was first opened through Freud's investigations of the unconscious, one invariably finds the presence of an unsuspected discrepancy. This discrepancy has been variously formulated by various investigators. The conception that seems to me to afford us the clearest insight into the essential nature of this discord is this factor of an image substitution and the artificial interval that it necessarily creates between the individual and his environment.[1] In this image projection there is invariably disclosed the existence of an arbitrary division mentally posited by each individual between himself and

[1] "Social Images versus Reality", paper read at the Fourteenth Annual Meeting of the American Psychopathological Association, Philadelphia, Pa., June 7, 1924. Published in *The Journal of Abnormal Psychology and Social Psychology*, Vol. XIX, No. 3, October-December, 1924.

others. There is thus unconsciously present within each individual the assumption of an actuality comprising himself that stands contrasted with an actuality not himself. His basic position consists in the postulate that he is different from others. This image projection is, in my finding, the essential root of the mental conflict that is the basis of the individual's present adaptation to his fellows.

This basic contrast, that is the private distinction of the neurotic individual, I find rests upon the cosmological theory, held unconsciously by every individual, that human experience is divided into good and evil. In this assumed cosmogony, divided as it is between the contending forces of evil upon the one hand and the forces of good upon the other, one finds that the individual invariably regards himself as the unwilling victim of the forces provocative of evil, the while he identifies himself with the forces promotive of good. The individual, in a word, projects a drama of human conflict in which he himself invariably assumes the character rôle of the hero.

Through this projection of himself as hero, the individual necessarily becomes at the same time both actor and onlooker. But whether one is a hero to others or to himself, the underlying mechanism is the same. Whether the personality in question is an outstanding character of history or the introverted neurotic personality, there can be no hero without an audience. If one assumes an image of himself, there is necessarily that part of himself from which his image is projected. If one assumes mentally the rôle of hero, one necessarily assumes mentally the rôle of hero-worshipper. If the individual performs a part, he also observes himself in the performance of it. If one part of him acts, the other looks on at his own acting. In this way the individual acquires a twofold basis; the one personal, the other social. I mean by this that in holding an image attitude toward himself, he necessarily holds a social or opposite attitude toward himself. But the individual's division is further reduplicated. For the same image that divides him from himself at the same time divides him from others. The same division that is personal within him of necessity becomes by extension social also. It is precisely this division of the individual into actor and onlooker, and its extension within the social mind, to which we owe the birth of the hero.

That division is the basis of mental disorder is now a commonplace. Schizophrenia or the divided mind has become the paradigm of the insanities. This division of the schizophrenic is again the division between good and evil. The schizophrenic is pursued by evil spirits which exert upon him a malign influence wholly alien to his innermost thought and feeling. Their diabolic smiles in-

sinuate themselves before him upon every side. He hears their voices calling to him. They whisper in his ear of carnal things. But he cries out in righteous indignation against their dark enticements. In this way they stand opposite to him, these sinister beings, and become the foil against which his own heroic resistance stands out in strong dramatic contrast. Thus in his autocratic image of himself, the schizophrenic stands as Prometheus or Christ ministering between God and man. He occupies toward his environment the same intermediary rôle as these historic heroes. As the emissary of God or of the forces of good, he would, like them, bring salvation unto men, and through his mediation deliver them from evil. But though he is the saviour of men, they at the same time persecute and deny him.

Note how good is the schizophrenic in his image prerogative, in contrast to others about him who are full of iniquity. Observe the contrast, the image interval, the division with which he looks upon himself and with which he bids others look upon him. Observe the identity between the image element and the social element—how the insane individual, in dividing himself from himself, by the same mechanism divides himself from others also. This is the division that is insanity. This is the division that is the hero. As there can be no hero without an audience, there can be no insanity without an audience.

Consistent with elementary principles science has always proceeded to the discovery first of the part or particular, and has then extended its application to the general. But this principle of science, which has applied itself so meticulously in the objective sphere, has not been consistent in its observation of the subjective processes involved in the study of man himself.[1] From the observation of the individual, science must now proceed, I think, to the general principle involving all individuals. In this course we shall be brought to see that the schizophrenic condition which we isolate in the clinic is the part or particular incident of which a general societal condition is the completer story. I do not think we realize that every individual is the prey to a divided mind in which he unconsciously simulates a rôle the while he looks on in naïve approval of his own simulation. I do not think we realize that with each individual there is a division based upon this same mental predicate of good and evil, and that in this division the individual himself is ever the noble champion of good in the midst of contending influences of evil.

[1] "The Laboratory Method in Psychoanalysis", paper read before the Ninth Congress of the International Psycho-Analytical Association, Bad Homburg, Germany, September 1925. *The American Journal of Psychiatry*, Vol. V, No. 3, January 1926.

Because of the universality of this mechanism, I should like to speak of a view that appears to me to warrant a wide and much needed generalization in respect to the consciousness of man as a whole. As well as I can express what I have in mind, there would seem to exist a condition of unconscious or symbolic polarization operating throughout the mental processes of man generally. The hero and his audience embody this reciprocal condition of polarization. The state of mind of the hero is complementary to the state of mind of the audience. In an inclusive, organismic view this polarization is in reality a social form of schizophrenia, and what we call individual schizophrenia is but an exaggerated symptom of this general social expression. In this phenomenon of schizophrenia or polarization, which I regard as a universal condition of the mass mind as well as of the individual mind, there seems to be presented secondarily a condition analogous to the polarization we know chemically as the property of matter.

Of late years man has come to study many of the inadvertences of his own growth. We know that certain organic processes have become artificially replaced by mental substitutes. A phobia or obsession is made the surrogate for natural processes denied their fulfilment. Among the primary conditions of man's organism there exists the physiological polarization of elements into male and female—a condition which we know to be as invariably the property of higher organic forms as chemical polarization is the property of matter. But through the frustration of this principle of organic polarization within us, the species of man has throughout apparently fallen a prey to a compulsive form of compensatory *mental* polarization representing a symbolic surrogate for the primary polarization inherent in his organism. My position is that this artificial polarization is rampant among us, and that our social involvement in it as a species has quite blinded us to its personal existence within each of us as an individual.[1]

The distinguishing mark of this schizoid tendency in the individual is its power as a colonizing reagent socially. Whether it exists in the activity of the soldier or in the passivity of the saint, its underlying dynamic is the same. The one obtains his ends through loud affirmation, the other through silent abnegation. The latter, however, is not less powerful than the former in his facility to colonize his environment. The one may stimulate his audience as well as the other but, like the other, he is not less stimulated by it. The hordes who follow Ghandi are as numerous and as powerful as the legions that followed the Emperor of the Germans. One

[1] "A Relative Concept of Consciousness", *The Psychoanalytic Review*, Vol. XII, No. 1, January 1925.

social reaction represents the positive, the other the negative pole in this process of unconscious colonization. If the cry of the war patriot, " Give me liberty or give me death ", is electrifying, that of the peace-abiding seer, " Except ye become as a little child ", is no less inspiring. In reality, however, these figures no more dominate the world by their influence than they are dominated by the world in its influence upon them. In each case the inter-reaction of the individual and the social mind is reciprocal. They present a state of unconscious social polarization.[1]

In this tendency, then, of polarization the individual who is hero to his own mind becomes through a process of social reciprocity the hero to other minds about him. Due to the fact that in the individual's composing these other minds each has likewise erected a hero of himself, all of them become readily identified with this outstanding dramatization of some particular individual. If the phenomenon called Napoleon created France, France no less created the phenomenon called Napoleon. This reciprocal polarity, it seems to me, is the social mechanism answerable throughout for the historic phenomenon of the hero. If the hero creates his audience, his audience no less creates him. The paranoid reaction precipitated through Napoleon's projected image of himself embodied a dissociation which received its socialization in the contemporary image-reciprocity of the current mind about him. But the polarity of Napoleon, as of any single individual, falls down utterly upon analysis. It is but the part, the portion, the other side of the picture; and the part sustained is only sustained by virtue of the audience. It is the half that is presented in contrast to the half that looks on. For actor and audience exist at one and the same time within the consciousness of one and the same individual. This is the splitting or division that is the drama of the clinic. This is the mechanism described in pathology as schizophrenia. But as actor and audience exist at one and the same time within the individual's mind, so do actor and audience exist at one and the same time within the collection of individuals comprising the social personality as a whole. In this view the schizoid diathesis

[1] An example of our heroic myth-making is nowhere more outstanding than in the rocket ascent of the political hero of the moment, Benito Mussolini. Here is the typical expression of a social reaction which, individually, would undoubtedly be classified in the psychiatric clinic as of the manic-depressive type. On the other hand, the reaction of the Fascisti (who have gathered about their leader as fatally as iron filings gather about the pole of a magnet) can only be regarded from a laboratory viewpoint as a social counter-reaction that is due to the hysterical sensitization of the adjacent milieu. Again where there is the hero there is the social counter-reaction that automatically plays opposite its hero in such pathological bi-dimensional mass reactions. See *The Life of Benito Mussolini*, by Margherita C. Sarfatti.

exists socially as well as individually. This social neurosis, which as inevitable participants in it we are all naturally loath to concede, is a serious impediment to human progress. Acting centripetally upon the individual it operates to isolate him within his own mind. Acting centrifugally upon the mass mind of which he is a part, it tends toward a distribution of images that operates no less to dissociate the social elements involved. One manifestation represents the psychasthenic, the other the hysteric type of reaction.

It would seem, then, that the image standing to us socially as the hero possesses an element that is quite as dissociative and hallucinatory as the images we have long recognized clinically as characteristic of the individual insane. It would seem that the unconscious polarity responsible for our hero and our hero-worship is really symptomatic of a neurosis that is societal as well as individual.

In its attitude toward the hero the social mind has expressed itself time and again in reactions that are really symptoms of its own mass dissociation, precisely as the part or organ of the individual may for the individual's convenience be forced into a symptomatic or conversion expression. This reaction has occurred repeatedly over certain historic periods. The effect of this mechanism sociologically has been to thrust into a dissociated position of isolation that individual whose personality is best adapted to symbolize the repressed and unconscious trends that mark the historic period in question.

Psychologically one hero illustrates all heroes. The outstanding hero of our own era is represented in the character rôle of Christ, and in him pre-eminently there may be seen the mental element of division or the heroic rôle and its corresponding social polarization.

Christ, the man, is not understood because mankind has wished to substitute for him the superman of its own dissociated fantasy. But it is not wise to place human personality at a distance. Our estimate becomes distorted and artificial. It is an interruption to organic continuity, and no substitution may fill the interval caused by this organic breach. The attitude of Jesus Christ was ever characterized by this interval. He looked out upon life and talked and felt only symbolically his identification with the processes about him, and mankind has inevitably responded in a no less dissociative manner. It returns Christ's detached gaze with a gaze that is not less dreamy and discontinuous with the actuality of things. As the hero, so the audience. Christ's erudition arose from an internal source and not from external acquirements. This was its claim upon the innermost sanctuaries of man's consciousness.

But had Christ presented a united consciousness individually, the social reaction to him embodied in Christianity could not have been the dissociated and hysterical manifestation that it is.

Christ was hypnotized by the *picture* of his truth rather than animated to its organic functioning. Correspondingly in our sentimental portrait of the comely youth of Galilee we are caught up in a mystical poetic mood, and under its vicarious spell we substitute the illusion of historic drama for the analysis of the biology that underlies it. We read that Jesus was miraculously born, that little is known of him from his childhood to his thirtieth year. These and like references are familiar theatrical tricks with the dramatists, and subtly herald the element of mystery. At once the dissociative emotions are stirred, and we are straightway eager with expectation of the pictorial and discontinuous, the element that is the fascination of the world across the footlights. Our pictures of Christ are touched throughout with these intimations of unreality.

On radiant mornings he stands amid the golden grain of wheat fields surrounded by the eager faces of little children, or alone in the dusk of evening he walks beside the sea. He is described as lonely and full of sorrows. His bearing is majestic and remote, his tread measured and rhythmic, his outlook ever calm and pensive. But most characteristic of all is his detachment. In some mysterious way he is entirely apart from the system of things, social and economic. Their turbulent vicissitudes move him not, and we are hypnotized, entranced by this picture of the Son of God.

When the historic phenomenon called Christ can be divested of the element of dramaturgy as of its hallowed individualism and viewed as a state of mind, the state of mind embodied in our own ethnic response may also be described and analysed. The character portrayed by the hero is the part he discloses, but there remains the part that he withholds. It was the tragedy of Christ that he contained a secret to which he had not himself access. "I and the Father are one", he said. "He is in me and I am in him." "Except ye do the will of my Father." Very beautiful and picturesque this intimation of an all-provident source with which Jesus felt himself continuous, but the beauty that is merely picturesque does not touch at any point the organic verity of which it is but the symbol and sublimation.

As we need not seek beyond the character of one hero to illustrate psychologically the character of all heroes, so one incident in the life of a single hero suffices to illustrate the mechanism underlying the entire psychology of the heroic rôle. There is a certain scene in the legend of Christ which illustrates poignantly the schizoid

element in Christ as in his interpreters. At this point the in-interpreters of Christianity have for two thousand years followed the way that leads man aside from his organic unitary course. I should like to return to that spot, and to indicate in the light of the slowly gathered experience comprising man's mental history the way for reconstructing his clearer evolution.

The parting of the ways that is man's dissociation may be best revisited to-day if we will return to the incident in which we find Christ attempting to deal with the woman taken in adultery. She has just been thrust into the presence of the Master. She was dragged before him, you remember, by a rough and angry crowd of men who wish in their righteousness to stone her to death. The woman stands there cowering and breathless. She is still flushed from the excitement of the lusts in which she has been overtaken. The mob about her tell Jesus of their wish to stone her. But Jesus is obviously ill at ease. We see him bend to the ground and begin writing. It is clear that he is confused and is endeavouring to temporize. Finally, raising himself up, he says, " Let him who is without sin among you cast the first stone at her." And we know how all of them, from the eldest even unto the last, crept away muttering and confounded. Jesus had well calculated the effect of his words upon them. When they had gone and he was left alone with the woman, he continued still to bend over and to make as if writing. The woman stood awaiting his judgment upon her. Jesus was trembling with fear. But his fear lay deeply buried and internal. It bore no mark upon the surface. After some moments of silence, as the woman remained standing there, Jesus said : " These men have not condemned you, have they ? And it is clear why they have not condemned you, is it not ? It is clear that it is because they are as you are, not without sin. Well, neither do I condemn you."

This startling contrast between the attitude of Jesus and that of her self-righteous accusers must naturally have awakened the interest of this woman, inured as she was to much conflict and perturbation of spirit. We know very well that her intense personality must have been stirred to its depths by the intense personality of Jesus. We know that something very real was imminent here. But just here the curtain is suddenly rung down upon the scene. The historical play-producer cannot endure to admit before us the spectacle of reality. In the interest of stage business this woman, who could not have been withheld from searching into the real soul of Christ and laying bare her own, must somehow be gotten quickly off the stage. In order to preserve conventional theatrical effect this vital man and woman must act an artificial part. They

must play but the half of themselves in order to satisfy the artificial part or half within the historical listener who in turn dares not act out but the half of his own personality. For the historian may only present his characters in the light of the social polarity in which he himself participates. And so Jesus and the woman with him must substitute for their organic polarity, a polarity that is born of the artifices of symbolism and stagecraft.

Two thousand years have passed, and this man and woman still stand confronting one another. But after two thousand years we may discount the stage business that would set them before us in the light of hero and heroine. To-day there stand exactly the same man and the same woman. But we may draw closer to them to-day because of our own closer self-realization. We may recognize that biologically Christ was not aloof, that he was rendered aloof by the artificial polarization existing within the social mind about him as within him. Christ is a simple human personality, composite of man and woman, even as you and I. What we call Christ and have localized in the legendary figure that trod the fields of Galilee two thousand years ago is an organic type that may be seen to-day threading the crowds on Broadway or toiling somewhere upon the open plains or bending within the depths of mines. He is artist and mechanic; he is the outlaw as well as the student in the theological seminary. But for two thousand years we have forced him to stand as a myth in front of us, arbitrarily projected by our own fantasy because we fear to acknowledge our identity with the soul of man everywhere.

This scene, so long confused and set so high above us and so aloof, is in reality a scene of every day in the life of every man. It is the meeting of one personality with another. It is the organic polarity of male and female. But each of us meets this same occasion with the same pretence with which the historian represents the meeting of Christ and the adulterous woman. This scene as rendered by the historian has been created for the private delectation of the hero and hero-worshipper. It is only historically, dramatically, true. Organically, biologically, it is false. It has no place in the life of man to-day with his larger possibilities of freedom from the dissociations of a mystical and unconscious tradition.

It is at the point at which the curtain is suddenly dropped that the real drama begins. It is at the point at which Christianity apparently draws the veil across its features that the face of reality begins to appear. It is here, as in countless other instances in the legend of Christ, that humanity becomes busy with its myth-making. Its spokesmen become alarmed, and in their fear and repression turn to substitution, dramatization, and pretence. This man may

not live his own life any more than they may live theirs. In their self-flattery and untruth they are driven to project a compensatory image which will be their hero, and this man of Galilee is admirably adapted to play the needed character rôle opposite their own. Besides, this man was to become God. His confession of human weakness, of kinship with his kind in their secret voluptuousness and self-satisfaction was not to be tolerated. Nor was Christ himself articulate enough. He was too intrigued with his own picture to surrender it, and his social *vis-à-vis* were reciprocally too intrigued with their transfigured picture of him to permit him to surrender it.

But, rending the veil of fantasy and of myth in the soberer mood of analysis, we may view the man and woman standing before us in the definite outline of their human personality. This woman, from the moment she heard Christ's words to the men who would stone her recognized clearly her kinship with him. She knew what no Christian has dared to know—that when Christ said to her, " Neither do I condemn you ", he meant as clearly as words could express it that sin was no more alien to him than to her or to the men who would stone her. She must have felt deeply this effort of His soul to escape from the false bonds in which the world elected to place Him. But it has taken two thousand years before this realization ventures to make itself felt within the divided life of man and woman. When he said to her, " Neither do I condemn you, because I too am not without sin ", Christ made a real effort to break through the schizophrenic introversion within and about him, and make contact with the actual throbbing human world as it exists in its reality. His statement was not as bold as this, but its intimation was as clear, had there been ears sensitive enough to comprehend it. But the social environment is not sensitive to organic intimations. An habitual amnesia bars out the reception of stimuli from the native media of actuality.

To-day after two thousand years we may reconstruct this scene that was so rudely interrupted by the historical dramatist. And if we will listen attentively we shall hear the man, now no longer stooping to write upon the sand, say to the woman : " You are turning to go—but what way is open to the personality that is divided within itself ? You thrust me away from you, you place me apart as an image to be looked upon. You wish to worship me as though I were a hero, an idol, as someone different from you. But this is interval, repression, substitution. Pain and repression are not a condition natural to the organism of man. May we not as one race and as one people feel and share life as a whole, no longer guarding our human values as processes separate and distinct within each of us ? " And to-day the woman, scorning the stage business

to which our race has been tutored from its childhood, seeks at last to break through the artificial barriers of our social reserve. These two kindred personalities so long torn within themselves and from one another will permit themselves to be separated no longer. They will no longer play the symbolic part or half which, until now, they have been forced to enact in unconscious obedience to their heroic or image attitude toward one another.

There is the need to recognize that the hero who has been worshipped from afar is also worshipped in the immediate contact of one individual with another. For after all, the hero of the race as the hero of the individual is but the image of oneself as inculcated through the image of the mother. As this image of the mother stands between the individual and the actuality of the race from which he has sprung and of which he is a part, so this image bars him from contact with the actuality of the vital human being, man or woman, with whom he stands in immediate daily relationship. As this illusion of the hero separates man from the history of his own past, it separates him no less from the immediacy of his ever-pressing present.

An analysis of the individual consists in the arraying of evidence to show that the individual is preoccupied with the mother-image to the exclusion of the eventualities that surround him, and that he repudiates his part as agent and sponsor for them. An analysis of the social mind as demonstrated in the laboratory of actual experiment has made it clear to me that the social personality is equally preoccupied with the mother-image, but that it is likewise not less agent and sponsor for the conditions and events surrounding it than the individual mind. It is this tendency to image substitution within the individual that has occasioned his dissociation from reality. This same image substitution and irresponsibility which we find within the personality of the individual characterizes no less the personality of society as a whole. The individual has his alternatives of saint and soldier, hero and villain, good and evil. The social mind is not less bidimensional in its image ambivalence, and it is based no less upon an equally traditional fairy lore of good and evil, saint and soldier, actor and audience. I do not think, however, that we have as yet recognized that this mechanism of division or schizophrenia is a social manifestation, that it exists in presumably healthy clusters of individuals no less than in the individually sick personality, and that the division we habitually ascribe to the individual with his heroic rôle or image dissociation is reciprocated by a division based upon the heroic rôle or image within the social mind generally.

What we call individuals are not individuals. They are actors

of a social part in which they themselves are at the same time the secret onlookers. What we call society is not the generic continuum that we think. It is a dissociative assemblage of individuals who, as audience, play an equally vicarious rôle in automatic response to the rôle that is played opposite them. There is the actuality of the outlying world, material and social. But within mankind there is the inaccessible secret that does not admit it beyond the bounds of outer surface and symbol. It is this that is division. It is this that insulates each individual from every other. Communication is henceforth necessarily only symbolic. It is gestural, mechanical, not organic and continuous. Under its general covenant people are united by a common code, not by a common consciousness.[1]

The man or woman of to-day in the midst of his perplexity and pain still confronts the man or woman whose perplexity and pain are no other than his own. But history still continues to enact the revery of the historian. History still outrages the organic principles of man's biology with substitution of the drama and the image. And we as participants, as audience, continue to applaud these spurious scenes. Must we remain so utterly oblivious of the claims of man's native actuality? Is it not time that we bring our laboratories, our clinics, and our philosophies to bear upon a situation that involves the individual and the race in the mutual enactment of this unconscious social charade?

[1] "Psychiatry as an Objective Science", *British Journal of Medical Psychology*, Vol. V, Part 4.

THE PROBLEM OF VERBAL LOCALIZATION[1]

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It is a very widespread opinion, but one which is none the less entirely inaccurate, that none of the cerebral localizations relative to language can be maintained to-day. Though different views are opposed to the old ones, there are unquestionable anatomo-pathological facts in evidence of localization, which, though less exact than we might wish, is much more so than certain writers would have us believe.

To begin with, we know that in the great majority of cases, the lesions which involve disorders of speech and language are those of the left hemisphere, and injuries to the left brain during the war have once more fully demonstrated this. Moreover, aphasia is most often accompanied by right hemiplegia. There are, however, individual differences, and there are people who from the point of view of language are cerebrally right-handed; and it has often been observed that left-handed people, whose motor predominance is governed by the right hemisphere, and who are consequently cerebrally right-handed for movements of the hand, are also cerebrally right-handed for language.

But the connection is not necessary, and cases have been observed, though in very rare exceptions, where aphasia was produced by a lesion of the right hemisphere among right-handed people, with a motor predominance of the left hemisphere, or indeed where aphasia was produced by the lesion of the left hemisphere among left-handed people.

In any case the function of language is connected asymmetrically with the integrity of one of the cerebral hemispheres alone, and that of itself implies a localization.

In the second place, it can be stated that aphemia on the one hand, and Wernicke's aphasia on the other, as Pierre Marie also maintained, are conditioned by lesions of totally different regions

[1] The following contribution will form part of Professor Piéron's volume entitled *Thought and the Brain*, which is to be published in the *International Library of Psychology* in the autumn.

of the hemisphere concerned. Comparison of the clinical data has established the fact that, in the first case, the lesion is located in the large cerebral quadrilateral known as the lenticular area, which includes cortical elements (the insula) and subcortical elements (bundles of capsules, the lenticular nucleus of the striate body, and the outer wall); in the second case, the lesion extends throughout Wernicke's area at the confluence of the three lobes, temporal, parietal, and occipital.

The legend of the failure of localization follows quite simply—if we free the anatomical problem from psychological theories—from the fact that Broca's centre, the foot of the third frontal, considered as the seat of the lesion peculiar to aphemia, has become discredited and is eliminated from Pierre Marie's quadrilateral, which stops at this point.

But whether the lesion of aphemia should be exactly at the foot of the third frontal or a little farther on—the errors of the various authors being explained by the frequency of the concomitant degeneration of Broca's area in the arterial embolism which, in the neighbourhood of the fissure of Sylvius, usually involves aphasia —hardly affects the notion of localization. As a matter of fact, Pierre Marie is not very definite, for, like a wise clinician, he objects to theoretical constructions and premature hypotheses.

Although a tentative theory of aphemia—designated by the term ' anarthria '—as a simple difficulty of articulation, has doubtless seemed compatible with injuries of the sub-cortical centres, such as the lenticular nucleus (though such a theory has never been expressly formulated), what appears to be essential in the large quadrilateral is the region of the insula, which in a sense forms the prolongation of the base of the third frontal, without any precise limitation, together with individual variations for the division of the architectonic areas.

And, though we can no longer admit that aphemia results from the loss of motor images of words, deposited in the cells of the cortex, but must suppose that elocution depends on a motor co-ordination centre, we are justified in localizing this centre in the region of the insula, in the immediate neighbourhood of Broca's centre and perhaps impinging more or less on it. In any case, there is a cerebral area in the anterior part of one hemisphere, nearly always the left, the exact limits of which are not established, but whose integrity is necessary to elocution, regarded as an independent function.

On the other hand, the intellectual function of language which is injured in ordinary Wernicke's aphasia is conditioned by the functional integrity of a cerebral area in the same hemisphere, situated further back and including the area enveloping the posterior

part of the fissure of Sylvius (lower parietal convolution as far as the limit of the occipitals, first temporal and part of the second in the posterior region).

Here we have the area of verbal thought; so that this form of thought has an anatomical seat, and Pierre Marie's conception, so far from being the weapon against all localizing theories which some have tried to make it, rather involves an essentially localizing principle such as is required by the facts themselves, since verbal intelligence necessitates, in his opinion, the integrity of a very limited area.

But, on this view, the area is envisaged as a single whole, with no dissociation of sensory verbal centres which condition auditory or visual comprehension and are injured separately in verbal deafness and verbal blindness respectively.

The area of verbal thought would lie between the common centres of sensory reception, auditory in the temporal area and visual in the occipital, though without including them.

But there are cases of pure verbal blindness of which the war lesions provided further examples, as Pierre Marie has recognized, and even cases of pure verbal deafness. Here the lesions are different and are found at the opposite limits of Wernicke's area: in verbal blindness they are located either in the cortex or in the white matter, at the limits of the occipital lobe towards the region of the angular gyrus; in verbal deafness, in the middle of the temporal area.

Limited areas, therefore, certainly exist in the sphere of verbal thought, corresponding to centres of sensory co-ordination, the existence[1] of which is required both by clinical facts and by psycho-physiological analysis.

It is impossible to determine precisely the limits of these centres. Does the angular gyrus which was regarded as the seat of visual images of words (and which might be the relay station ensuring the dynamic co-ordination whereby images are produced, but which probably plays a rôle especially in the co-ordination of motor reflexes of visual origin) really correspond to this function, as

[1] In Henschen's fine publication, co-ordinating the results of 700 anatomo-pathological observations of aphasia, we find clear indications of definite localization, different for language, music, and calculation, and even partial localizations for words and syllables. Though the general conceptions of Henschen, who adheres to classic doctrines, can no longer be accepted, the facts, which ought to be incorporated in the new interpretations, cannot be neglected. Cf. S. E. Henschen, *Klinische und anatomische Beiträge zur Pathologie des Gehirns*, V-VII, 1920; Henschen's own summaries ("Les altérations de la faculté du langage, de la musique et du calcul", *Rev. Neurol.* 1920, XXVII, pp. 1089-1094); and those of André Thomas ("Aphasie, amusie, et acalculie d'après Henschen", *L'Encephale*, December, 1921, pp. 605-614).

Dejerine would have us believe? It is still impossible to give a definite answer. But it is perhaps in the occipital lobe itself, on the lower internal surface, or perhaps in the angular gyrus, in any case fairly close to it, that we should look for the centre of visual co-ordination implied both by rapid reading and by the evocation of verbal visual representations (hence the inexactitude of the term alexia, which Pierre Marie and his pupils prefer for theoretical reasons).

The centre of auditory co-ordination for the comprehension of speech and the evocation of auditory representations is located in the temporal lobe, though we can neither delimit it very precisely nor determine its relations to the auditory receptive area, about which, unlike the occipital visual area, relatively little is known.

As for the probable centre of kinæsthetic co-ordination, which may be placed between the temporal auditory centre and the motor area, the absence of sufficiently clear clinical data does not as yet allow localization, in the proper sense of the word.

Aphemia, like apraxia, is connected with an injury to the mechanism of motor co-ordination, and this mechanism has a cerebral seat which we can place almost exactly. The centre of graphic co-ordination where the lesion of agraphia is located is situated at the edge of the base of the second frontal and the ascending frontal, at the level of the incito-motor centres for the hand.

The other forms of apraxia depend on analogous but less complex mechanisms, the seat of which we have not yet been able to determine with certainty, or even approximately; we only know that it must also be sought as a rule in the left hemisphere, and that it may be found neither in the occipital area nor in the temporal but only in the fronto-parietal. Vague though it still is, this first approximate localization is already a considerable achievement.

Similarly agnosias, losses of perceptive comprehension for common objects, are connected with lesions of one hemisphere only, nearly always the left: though occipital lesions give hemianopsias, right or left according to the hemisphere damaged, we still sometimes find visual agnosias with right hemianopsias, in spite of the preservation of macular vision. Verbal blindness itself, a more limited agnosia, coincides nearly always with this same right hemianopsia. A lesion which involves functional loss of the mechanism of verbal visual co-ordination may, in fact, extend to the occipital area of direct reception, or especially affect the radiations which bring the visual impulses to this occipital area, radiations which pass under Wernicke's area and enter this area in the infra-structure of the angular gyrus.

We know enough then to assume, on anatomical grounds and

without any imaginary constructions, the existence of limited cerebral areas corresponding to the sensory or motor co-ordinating functions implied by psycho-physiological analysis—the existence, that is to say, of real *co-ordination centres*.

We also know enough to affirm that round the co-ordination centres of verbal reception there extends an associative area which conditions verbal thought. The co-ordination centres are the points of insertion through which sensory impressions act and from which concrete evocations start; they are the supports without which the entire structure crumbles, and all verbal functioning becomes impossible; but this functioning cannot continue, even though the co-ordination centres remain intact, if the association paths get confounded by a lesion that injures the area of verbal thought as a whole.

So long as the associations which arise from the other sensory impressions, feelings, attitudes, etc., remain possible, non-verbal thought, which is conditioned by the other association paths as a whole—with peculiar forms linked also to limited areas[1]—may continue normally, if functional disorders, resulting from the pathological accident which produced the aphasia, do not extend to the entire brain.

And the progress of our knowledge of nervous functioning allows us to conceive of the part played by the relay stations throughout this dynamic mental system, by neuronic syntonization.

In reality, our anatomo-physiological conception of language and thought is gradually improving, gaining in exactness what it may lose in apparent precision. We must renounce—as previously for the re-direction of neurones by amœbism—the idea of three or four reservoirs of images, painted in blue or red on diagrams of the brain, but this does not mean that we must renounce the localization of the real functions which have taken the place of the entities with which the localizers of earlier times worked.

It need not greatly surprise us that our attention to scientific exactitude does not give us more precision, for some of the chief reasons can readily be indicated :—

To begin with, we find ourselves dealing with rough and generally diffuse injuries, in extraordinarily complex and delicate mechanisms, involving complex clinical states; we cannot experiment, and it is to the unhappy accidents of pathology alone that we owe the possibility of extending our knowledge of the lesional processes due to vascular disorders (embolism and hæmorrhage), which depend

[1] Thus thought, by visual schematization, depends particularly on the association paths near the occipital lobe, and orientation alone may be injured in certain limited lesions, etc.

on the distribution of the arteries and do not oblige us by limiting themselves to small areas with autonomous functions. The wounds and injuries caused by projectiles during the war—generally also complicated by hæmorrhages and vascular disturbances—the microscopic overflow due to concussion, gave rise to disturbances less ordinary, though sufficiently complex. But in only a few cases could we make anatomical examinations to complete the clinical analyses.

Again, functional analysis generally remains very rudimentary and limited to the needs of the clinic; while the great majority of the available anatomical examinations are also very inadequate. Localizations have been established according to the morphology of the convolutions, which have no necessary connection with the functional areas: they correspond to the cell structures which the cyto-architectonic of the brain has begun to establish, and which often cover different convolutions.

Another new difficulty lies in the individual variability which is possible in psycho-physical mechanisms, and which is beyond doubt constitutional: cerebrally right-and left-handed individuals provide an obvious example of this. The cyto-architectonic shows that the relations of functional areas with morphological appearance vary greatly with the individual, so that any judgment based on the appearance of the convolutions—which are already so variable—is suspect. Finally Moutier has emphasized the extraordinary variability of arterial distribution, of the vascular divisions and channels, in particular in the area of the fissure of Sylvius, which results in great differences in the complexity of lesions for an arterial embolus of a given trunk, according to the typographical type.

Add to this the great difficulty that we feel—especially when we have not been able to follow their evolution for long—in distinguishing disorders due to a true, irremediable, irreversible destruction, from functional ones, due to distant causes and sometimes lasting, which, when the retrocession occurs, prevent our assigning limits to the anatomical area that corresponds to them (a metabolism more or less affected by insufficient irrigation, compression, inflammation, etc.), to say nothing of the reverberations of diaschisis in the partially affected circuits.[1]

[1] This difficulty, even with a satisfactory correlation of psycho-physiological and cyto-architectonic examinations, will long preclude absolutely precise localization. Moreover this will probably vary too greatly from one individual to another, and involves groups of keys on the co-ordinative keyboard of language. But the existence of such localizations admits of no doubt when, with minimal lesions, we find limited disturbances not following Ribot's law of regression relative to the disappearance of mechanisms in an inverse order from their automatization. In diffuse and incomplete functional injury this law is essentially valid; and I found a very good example in one of my cases,

Finally considerable difficulties of interpretation are involved by the functional equivalence of the complete isolation of a centre through interruption of all its association paths and the destruction of this centre itself, separately, as contrasted with the very great difference in the appearance of lesions which are limited to the white matter in the one case and may be more or less limited to the grey matter of the cortex in the other. Interminable discussion may arise, for example, as to the significance of the angular gyrus in verbal blindness or of the base of the second frontal in agraphia, not to mention the fact that a complete or partial interruption of a great association bundle with a determined function (occipito-frontal, occipitotemporal, etc.), can occur at very different points of its extent with like results.

There even appears to be the possibility, in certain cases, though obviously much more rarely than is supposed, of functional recovery through the substitution (of one hemisphere for the other, for example, in praxic or gnosic co-ordination) of other cerebral areas, where a given functional area may be reconstituted.

Considering our difficulties, then, it is no mean achievement to have succeeded in limiting, even if somewhat vaguely, the areas in which certain centres are found or through which great association paths pass, such as those which condition verbal thought. And we must not expect rapid progress.[1] But the essentials are certainly there, and that suffices to provide a general conception, until more detailed investigation leads to more satisfactory results. There is an unquestionable correspondence between determined functions and definite cerebral areas, and though the localizations may at one time have seemed more precise they have never been more firmly grounded. This conclusion is inevitable for all who are acquainted with the facts and are honest with themselves.

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where aphasia resulted from an insufficient irrigation of the anterior and middle left brain, as the result of a ligature of the primary carotid. Henschen's evidence, too, provides some very clear anatomo-pathological cases of dissociation, showing isolated injuries of the co-ordinative keys.

[1] It must not be forgotten that even for the elementary functions, which lend themselves to direct experimentation there are reflex centres which are not yet precisely localized. The centres of muscular tonus in mammals are still determined only hypothetically. A fortiori, when we come to human reflexes, the uncertainty is even more marked. Not only are certain co-ordination centres for ocular movements still unknown, but even the ocular motor reflex has been located in the brain or in the last medullary segments; those of the cutaneous reflexes in the cerebral cortex or in the lower part of the spinal cord. And if war pathology has furnished data which are in many cases decisive, it is not less true that such uncertainty as to the seat of the reflex connecting neurones which govern the most simple reactions, and whose existence is unquestionable, shows us how cautious we must be when we encounter uncertainties or contradictions as to the localization of the connecting neurones involved in extraordinarily complex functions.

NEW WORLD CORRELATIONS

By HERBERT J. SPINDEN

We are entering an era of correlations in which the principal development in science will be the reduction of knowledge to simpler and more easily understood terms. Correlations in an ever-widening scheme are wise for several reasons. First, the reduction and humanization of scientific fact is necessary because the vastness of accumulated detail has gone beyond the limit of intellectual grasp: secondly, because some sciences are already feeling effects of the law of diminishing returns: thirdly, because some records are rapidly disappearing from the face of the earth.

To-day scientific research is advancing under a much greater momentum than in the past. The number of men studying the Americanist subjects has increased tremendously, and under improved methodology the grist of fact is being ground out more rapidly than ever before. But with increasing numbers there is greater specialization and a tendency to emphasize spectacular fringes and neglect the main fabric of truth. These flamboyant tendencies can only be counteracted effectively by co-ordinations which will make the part responsive to the whole. Anthropology as a master science should come to occupy a greater and greater plane in the scheme of co-ordination, especially in the American field. In the following pages I shall briefly suggest some interrelations of sciences affecting the program of this Congress.[1]

Was America the Home of the Primates?

We are accustomed to think of the Old World as the place of origin for the primates, the highest order of life, and the order leading to man. The accumulating data on the Eocene fauna of New Mexico, Wyoming, and other western states indicate that the home of the primates may have been in North America, and that such primitive lemuroids as the Notharctidæ in middle Eocene age rose out of such primitive insectivores as Nothodectes in the lower Eocene, or Paleocene as it is sometimes called. The

[1] This paper was read at the last Congress of Americanists at the Hague.

Tarsius group under Lemuroidiæ is also found in America, and this is supposed by paleontologists to be near the direct line of man's development. The Notharctidæ of the New World are tied into the available paleontological record in a better way than the contemporary Adapidæ of Europe.

In this connection it should be kept in mind that the extent of Eocene land in North America was much greater than in Europe. The North Atlantic land-bridge across Labrador, Greenland, Iceland, the Faroes, etc. was then above water, serving as a highway for land animals between the two hemispheres under favourable climatic conditions. It is now 1900 feet below the sea at its deepest point.

Also Europe at that time was cut off by wide seas from Asia and Africa. In other words, North America and Western Europe were parts of one continent.

The present American monkeys are higher than the lemuroids of either hemisphere, and may have arisen out of the Notharctidæ. There is a break in the paleontological record in America from Eocene to Pliocene or Pleistocene, and if the present American monkeys are not considered descendants of the geologically early forms then we must imagine an invasion from Asia via the Siberia-Alaskan bridge because the North Atlantic isthmus was submerged before the Miocene.

The Problem of Early Man

If the single tooth from a late Pliocene formation in Nebraska, assigned to a large anthropoid called Hesperopithicus, is vindicated as belonging to an upper primate, we may have a real problem of the anthropoidal precursors of man for America. Previous to the finding of this tooth evidence of anthropoid apes and of archaic types of man was wanting in America. Various animals contemporary with archaic man found their way into America from Asia.

Nevertheless, nearly a century of search has failed to furnish satisfactory proof of man in America before or during the last advance of the glaciers, and the weight of evidence now lies heavily against the assumption that paleolithic man was, in fact, present. An examination of the most primitive marginal types of Indian culture discloses the smooth stone celt and other characteristic products of the Neolithic period. Indeed it appears that the final dissemination of man beyond the limits of the Old World cluster of continents took place on this horizon, since the Australian likewise has smooth stone implements. The most primitive tribes

of the world seem to be safely Neolithic, but on the nomadic-hunting rather than the sedentary-agricultural stage.

Man probably entered America on the early Neolithic horizon before the invention of agriculture or the domestication of any animal except possibly the dog. The earliest possible date of his coming would depend on the retreat of the ice sheet from the road leading to the Siberia-Alaskan land bridge. It is believed that the glacial stages were roughly contemporaneous for all parts of the Arctic continental mass, yet criteria of age relating to the advent of man into America are of the vaguest sort. The archæological record in Mexico and Central America can hardly be pushed back beyond 3,000—4,000 B.C. for sedentary culture. Before this date and after the retreat of the ice are some ten thousand or more years.

The present differentiation in language and physical type among American Indians is supposed to be sufficient to cover a large part of this interval. The difficulty here is that the original stream of immigration was doubtless already mixed. Of course it is perfectly obvious that some correlation expressing the gist of history must be effected in America between the present incompatible classifications of culture, language, and physical type.

Properly speaking language is a social convention and therefore a part of culture. It seems to be by far the most persistent part, since the evidence indicates that the sundered members of the Athabascan stock, for instance, have but a small ingredient of common usage outside the forms of speech. Obviously the Aztecs and the Shoshone at opposite ends of the area occupied by the Uto-Aztecan stock, and at opposite ends of the social scale, must be brought into an original conformity, and the same problem remains for other far-flung language groups.

Physical anthropology has demonstrated the absence of archaic types of man in the known American record, and it has demonstrated that there is considerable fluctuation about a normal race standard. But it has not demonstrated a concordance at any stage with language. To say that physical classifications of American Indians cannot be correlated with cultural and linguistic classifications is merely to insist that physical characters are mobile and without value as historical criteria, except possibly in large averages. It is absurd for physical anthropologists to insist, in extenuation of their failure, that linguistic evidences of social unity can be neglected on the grounds that a physical entity in population may lose its language and other elements of culture. It would not lose these without some marks of the struggle and without some mixture of blood with the conqueror.

The Origin of Civilizations

That America was the home of a family of civilizations independent of the family of civilizations in the Old World in all the higher reaches of achievement is the contention of many anthropologists. If this contention is correct then such parallels as do occur on various planes of culture have a tremendous bearing on the innate potentialities of mankind, now considered to represent one species of animal subdivided into races, all of which had been lifted, as aforesaid, to a general level of the lower Neolithic before the species became cosmopolitan. Man was a creature perfected in mind and body, with tools, speech, and the rudiments of all important arts before he left home for the ends of the earth.

Civilizations are first of all dependent upon abundant and constant food supply. Without such food supply population cannot become dense, nor leisure be allowed for the graces of life. But civilizations are also dependent upon the creation of loyalties and inhibitions among the members of the social group. The American record indicates in very complete fashion the natural history of civilizations, from the family hunting band type of association up through the fisherman's and farmer's villages to nationalities including all the members of a language group and even to empires based on conquest and tribute. The psychological bases of leadership—blood, might, wealth, and magic—all are found in varying degree, in different parts of America. The blood-bond strikes curious parallels to the Old World in such institutions as cross-cousin marriage, totemic or non-totemic clans, etc. but to claim that these parallels mean historical continuity of an ancient pattern is unjustifiable. They may be reiterated answers to the mechanistic problem of making the family continuous. Ethnographic research shows that the higher types of social organization have their centres in areas of good food supply. Social classifications break clean across the linguistic ones in many instances, indicating that culture may rise or fall quickly, and is not necessarily permanent.

Culture Areas

The culture areas of American ethnologists rest on a static concept. They correspond to the nuclear distributions of dominant arts on a given horizon or historical level. To some extent they also correspond to environmental provinces, but it is recognized that life may be developed along different lines in the same environmental province, witness the nomadic Apache and the sedentary Pueblo of desert southwestern states. But human culture is dynamic, and if the vertical or historical changes are correlated

with the horizontal or geographical changes we obtain storm movements. That is, there is a flowing out from a cultural high into a cultural low, as on a weather map.

Convergence and Divergence

The doctrine of convergence, or of convergent evolution, has been used to explain striking similarities between the arts of man in different parts of the world, and especially as a reply to the argument that such similarities mean historical connections between widely sundered peoples. By definition convergence means that things originally different have become the same, and by divergence that things originally the same have become different. In other words the proof of historical continuity should be sought in divergence, while convergence in human arts means that some mechanical control affects the object.

These terms, convergence and divergence, are as applicable in nature as in human history, and the paleontologist, the botanist, etc. constantly use them. Outside of man convergence is generally explained by a constant environmental or mechanical factor or set of factors, acting upon different things and slowly transforming them. The same explanation will serve in the case of man, because human sensory organs are machines that select for quality. Also similarities in art are apt to arise independently because structure, as in textiles, acts as a limit upon design. In other words selection is controlled both in and out of man's body. The general history of the modification of tools, of designs, etc. shows that these are refined and specialized in much the same way as animals and plants in natural evolution.

Similarities in the patterns of social organization, in ceremonial procedure, in mechanical construction, in decorative design, etc. are all susceptible to convergences, and therefore cannot be used without support to argue historical contact between widely separated peoples, especially if we proceed on the theory that men are approximately equal in the matter of the mental and body machine, and that they all had an approximately even start on the Neolithic plane of culture.

Problems of cultural interrelations on the civilized plane between the eastern and western hemispheres must be decided on basic arguments, not on merely curious similarities. The points used in the notorious Heliolithic Theory are mostly curiosæ without really important relations to the matters of social life. Agriculture, dealing with an entirely different set of domesticated plants in America than it does in Asia, Africa, and Europe, more than offsets the couvade and other strange resemblances. Pottery, weaving,

and metal working in the archæology of America rise from a low to a high plane within spaces of time that can be accurately measured and fixed in a system of world chronology.

AGRICULTURE

Two principal places of origin of agriculture and domestic animals can be distinguished in the Old World and two more in the New World, as well as a number of secondary centres established in much later times. Of the two focal points in each hemisphere the older in each case corresponds to an arid tropical or subtropical environment, and the younger to a humid environment well within the tropics. The basic civilizations rising out of assured supplies of food may be classified as :—

1. *The Civilization of Wheat,* with its centre in Mesopotamia and the Nile Valley, and its principal extension eastward over northern India, the Tarim Basin, and the plains of China. The adjustment of wheat to the Persian highlands and to Europe came long after cultivation in the low hot valleys. In the food complex of this civilization we find wheat, barley, lentils, peas, grapes, etc. with cattle, sheep, and goats coming into use as sources of meat, milk, and butter. Rye, oats, cabbages, etc. were comparatively late domestications on the northern fringe.

2. *The Civilization of Maize,* with its original centre on the rather arid highlands of Central America. In this complex we find a strong vegetarian diet with maize, beans, and squashes occupying first place. Domesticated animals were few and relatively unimportant in the dietary; turkeys may be mentioned. The two arid-land agricultural complexes have no factor in common, plants in the two sets not being even remotely similar. That of the Old World may be dated tentatively as beginning about 5,000 B.C. on the evidence of recent explorations near the Red Sea, while the New World civilization may be somewhat younger in spite of the fact that the American plants in general are more highly domesticated than those of Asia (i.e. carried farther from the wild types and adapted to a wider climatic range).

3. *The Civilization of Rice.* The locus of this civilization was the humid area of southern China, Indonesia, and Bengal in India. In addition to rice, other important plants were yams, breadfruit, bananas, and coconuts. Pigs and chickens also appear to have been domesticated here.

4. *The Civilization of Manioc.* The corresponding civilization of the wet tropics in America, inaugurated by the Mayas before 600 B.C. according to the evidence of their calendar, was in considerable part supported by maize, beans, squashes, etc. modified to meet humid

conditions. But a number of wet-land plants were domesticated, including cacao, sweet potatoes, and the manioc root which furnishes tapioca and cassava. The best lowland culture of South America flourished near the mouth of the Amazon, and this appears to have been the original home of several domesticated plants including manioc. Both in the Old and New Worlds the humid type civilizations did not get under way till about the time of Christ, with the first indications of culture 500—1000 years earlier.

As regards food plants it has already been stated that the combined botanical, archæological, and historical evidence discloses no food plants common to both the Old and New Worlds. It is true that the botanical evidence indicates that the coconut belongs to a family nearly all of whose members are American, nevertheless it is very certain that the domesticated coconut was unknown here and that it was known in the Old World. Some cases may appear doubtful if all opinions must be given equal weight. Thus some persons, finding sweet potatoes widely spread in China, the Philippines, New Zealand, etc. have naïvely considered them native of these parts. But in the Philippines at least these roots still bear the Aztec name, camote, while yams were introduced into America under their African name. One may find statements that the banana existed in America, but the native names for it are nearly all variants of the Spanish platano.

Indeed only one species of cultivated plant appears to have been cosmopolitan at the time of the discovery of America, namely, the common gourd, well equipped to float its way around the world. As for cotton, the wild species have blown around the world, and are found on oceanic islands. Three species in America and two in the Old World have been reduced to cultivation. The Old World species are decidedly inferior. Also the archæological specimens of American cotton are much older than those of Assyria, India, or China.

In connection with American agriculture there are some extremely interesting problems in the genetics of plants. Archæology is able to restore the lines of migration for domesticated plants in America and the sequence of climatic adjustments. This is important because some of these plants, for example maize, have wider adjustments than the domesticated plants of the Old World. In the Pueblo area the lowest culture level shows a single type of maize of the flint variety. In upper levels we get flour corn of different colours, beans, squashes, cotton, etc.

Pottery

The co-ordination in distribution between ceramic art and agriculture is quite exact in America if we omit the unbaked, blood-

cemented pottery of the Eskimos. Some marginal tribes like the Mandan and the Huron probably received pottery as part of the agricultural complex. Nevertheless, we must also recognize that pottery is naturally an art of sedentary peoples which is of slight service to nomadic peoples. Some of the western Algonquin tribes on passing out of the agricultural area used pottery to a slight extent and then gave it up. Although records of pottery manufacture exist for the Shoshone and some other tribes of the Basin Area who had winter homes in the valleys and summer camps on the hills, it never was important among them. Similarly there is a discontinuance of pottery in South America when we leave the limits of agriculture, except for a marginal zone of sporadic cases.

Pottery art delimits special cultures by its full and permanent record of decorative art. Frequently it is found in stratified deposits which furnish evidence of historical sequence. It may give proofs of the interchange of mechanical ideas between culture areas. An example of this develops from the distribution of the tripod support which is a common character of pottery from Colombia to central Mexico, seldom met with in Peru, and never met with in the Pueblo area. Another example is the process of negative painting after the fashion of the batik, the design being put on with wax before the sizing colours are applied. This process began in late Archaic pottery in Mexico and extended as far as Peru. The shapes of the objects decorated by this process and the designs used were local, while the process was widely distributed.

The potter's wheel, known to the earliest Egyptians, was never invented in America, but for that matter neither was the wheel in any of its other mechanical uses known in the New World.

Glazing of a kind was used to a limited extent. First, there was a kind of self-glazing pottery manufactured in Salvador and southern Guatemala from a clay which suffused under fire owing to the presence of lead. Second, there was a true glaze paint used by the Pueblo tribes of New Mexico, the basis of which was galena. Colours on the warm register, especially reds, were widely used for sizing and also for painted designs, being mostly founded on the oxides of iron. In Costa Rica there was a local use of manganese to make a lustrous brown-purple. Light bluish colour possibly from the purpura shell fish, a species of Murex, is also used here to a very slight extent. But apart from this the only cold register paints are found in the Nasca and Ica pottery of Peru. Here the purplish blue is of unknown origin.

Textiles

Convergencies in textile art of the Old and New Worlds are seen in machines, form of weaving, and designs. The controlling factors are clearly discernible, and explanations of the independent inventions and the numerous convergences are not far to seek. While the first immigrants to America doubtless had mats and basketry and knew how to twist string, it is not likely that they were acquainted with flexible weaving. At least it is pretty certain that the loom and spindle whorl were invented independently in America. Also several fibre plants were domesticated, and several splendid dyes brought into use. If it is impossible for a stream to rise higher than its source, how can persons who wish to derive all worth-while American achievements from the Old World explain the wonderful perfection of the textile art in Peru ? For in variety of construction, fineness of weave, and brilliancy of colouring, Peruvian textile products are without rival anywhere.

The warp-weighted loom—if indeed this clumsy machine deserves the name of loom—does occur on both sides of the North Pacific among the Ainu of Japan and the Chilcat of Alaska. If the Scandinavians brought looms to Greenland they were doubtless of this type. But there is no suspicion of the warp-weighted loom in Mexico and Peru. The true loom principle emerges from basketry manipulation when some sort of harness is devised to move a whole set of warp threads in a single act—that is when a shed is produced. In America the loom—with warp beams, harness, comb, and batten sword—was distributed from Colorado to Argentine, following closely the distribution of cotton cultivation.

Practically all kinds of cloth were developed in America, plain weaving, twilling, tapestry, brocade, gauze, double cloth, etc. Also we find designs applied in a great many different ways, among which tie-dyeing in the warp and in the finished cloth may be mentioned. As regards dyes we have American indigo, distinct from Asiatic indigo, also the cochineal insect which was domesticated, and a purple dye drawn from a species of Murex. Here is a nice example of the independent seizing of similar resources in nature. The American Murex differs in species from the Mediterranean and Indian ones, and could not have been transported.

Metals

Another basic comparison between the civilizations of the two hemispheres can be made on metals. In Old World archæology we have bronze and iron giving their names to well defined levels of human culture, with the likelihood that some usage of gold and of native copper preceded the true Age of Bronze. This age may

begin as early as 3200 B.C., while iron came into fairly common use about 800 B.C. Metals are unduly emphasized during the grandiose stages of civilization in Egypt, Assyria, and China, and the use of bronze strikes a cultural horizon from Ireland to Japan.

In the New World, on the other hand, there was probably no very ancient use of metals, but several independent areas in which there was a late and partial use must be noted. Native copper was hammered in shape for tools, etc. in regions adjacent to supply, as in southern Alaska, along the Coppermine river, in northern Canada, and in Victoria Land. In the area south of the Great Lakes there was a similar use, not only of native copper, but also gold, native silver, and some meteoric iron. Although the Mound-builders made excellent repoussé designs on sheets of hammered copper, they never learned the art of smelting ore or casting molten metals.

In South America, the West Indies, Central America, and Mexico the knowledge of metals was practically continuous, except over the South American lowlands and those parts of Argentine and Chile lying beyond the influence of the Peruvian civilization. In the West Indies the gold apparently came from local sources in Porto Rico and Santo Domingo. Perhaps metal art among the Arawacks was derived from the mainland of Venezuela, where rare specimens are found. For the rest of the great area boasting metal work we can draw a line, as regards technique, across southern Colombia. North of this is found the pseudo-filigrane method of casting from wax models built up in thread-like details. This process was used over Colombia, Panama, etc. to Mexico. South of the division line, in Equador and Peru, the pseudo-filigrane technique is not apparent, although the lost-wax process was known. The finest pieces of Equadorian and Peruvian metal work are ornamented by repoussé.

On both sides of the technical dividing line we find a common knowledge of gold, silver, copper, and various alloys. Tin and copper were mixed to make bronze, but no definite formula seems to have been reached. Platinum was used in western Colombia and Equador, and lead was pretty certainly known in Mexico.

Now although the evidence is very clear that metal working came into Mexico from the south, it is also just as certain that there was no knowledge of it in the Maya area at the time of the First Empire, the dated monuments of which run from about 100 B.C. to about 630 A.D. No specimens of metal and no metal stains have been observed at Copan, Quirigua, etc. nor are metal objects represented on the early Maya sculptures as details of the dress, although shells and jade objects are clearly drawn. The ruin of Las Quebradas, belonging to the same age as Quirigua, is situated upon the richest

placer mine in Guatemala. Although most of this site has been excavated and many pieces of pottery and jade recovered, not one specimen of worked metal has come to light.

Under the Toltec kings, Huetzin, Ihuitimal, and Quetzalcoatl, tribute in metals was collected in Guatemala. Most of the gold sacrificed in the Sacred Cenote at Chichen Itza in Yucatan during this, the Toltec period, was imported from Costa Rica and Panama, and some came from as far away as the middle Cauca valley. From these facts we may conclude that the metal age in Central America and Mexico began between 600 and 1100 A.D.

The Calendar

A considerable number of papers bearing on possible relations between the civilizations of the New and Old Worlds attempt to draw parallels in the systems of counting time, and argue derivation of the Central American calendar from Chinese zodiacs, etc. Of course time-counts must take notice of facts in nature. The zodiac, as the path of the planets, is an observable thing, as is the length of the month or year. Time observations of some kind or other are universal.

Natural calendars of the sidereal year type, without months, are apparently the lowest, existing in Australia, South Africa, and the South American lowlands. In this type the heliacal rising of constellations in correspondence with the seasons is noted. Next follows the type with twelve months in a year, or thirteen when necessary. This luni-solar calendar is found pretty widely over the world—in parts of Africa, practically all of Asia and Europe, as well as North America. Mathematical calendars where the month becomes a more or less formal part of the year come in with high civilization, very often on the formula $12 \times 30 + 5 = 365$.

The Central American calendar is built on a system that finds no parallel in the Old World. It is $18 \times 20 + 5$ combined with a permutation of $13 \times 20 = 260$. The dates are the number of elapsed days from a mundane era which equals October 14, 3373 B.C. in the backward projection of our present Gregorian calendar The time-count began to function on August 6, 613 B.C. The writing out of the Maya calendar involved place-value a thousand years before it was known anywhere in the Old World, and an eral count of days 300 years before the first eral count of years in the Old World (The Era of the Seleucidæ, October 1, 312 B.C.). In other words an analysis of the science of ancient America shows products of high originality, and this fact relieves us from the necessity of explaining intellectually and artistically advanced features of New World civilizations by diffusion from Europe or Asia.

The conformity of natural time cycles which the Greeks reached in the Cycle of Meton was 19 years = 235 months = 6940 days. This is reached by the Mayas as 1 Katun (7200 days) minus 1 Tzolkin (260 days) = 6940 days. The Egyptian Sothic Cycle is an attempt at a natural cycle reached in marvellous fashion by the Mayas. The Egyptian Sothic Cycle is $1461 \times 365 = 1460 \times 365.25$, that is 1461 calendarical years equal 1460 years according to the Julian formula. But here the Nile flooded in accordance with the tropical year and the dog star rose in accordance with the sidereal year. These elements are really incompatible, the error being about 12 days in one cycle. In the Mayan arrangement, 29 permutation rounds of 52 calendarical years each equal 1507 tropical years. The error here is .0052 of a day. The Mayan calculations on eclipses, planetary revelations, and tropical years are marvellously accurate, and are expressed in a peculiar kind of mathematics associated with a peculiar kind of hieroglyphs.

The time-counts of Central America give a shaft of accurate chronology in the centre of the New World, and by taking note of trade specimens and linking features in decorative arts, ceremonies, etc. we can establish far-reaching horizons in archæology.

Diseases

Diseases caused by parasites invading the human body have local origins and are distributed by man himself. The chance that the same parasitical ailment might originate spontaneously in different areas is negligible. Of course the organisms of disease are vastly older than man. The human host may be the last of a series of hosts for the parasite. Nevertheless, the historical record pretty clearly shows that disturbances of this sort have a continuous history of dissemination from an original pathological adaptation. Since the conditions of the body vary but slightly according to climates the pathological agents tend to become cosmopolitan.

Parasitic diseases could hardly maintain themselves among men without reasonably dense populations. We may assume that the men coming into America were free from most if not all such diseases. After the independent inventions of agriculture some kinds of disease arose in America and others in the Old World, both in regions of concentrated population, made possible by the improvement in food supply.

The principal New World diseases were yellow fever and syphilis, the former practically limited to the humid tropics, and the latter more widely spread over highlands as well as lowlands among nearly all the agricultural populations of America. The story of the dissemination of this latter affection over the rest of the world

began with the return of Columbus, and ended with the discovery of the last island groups in the Pacific. It was the introduction of this ailment to the Hawaiian Islanders by the sailors of Captain Cook that led to the murder of that gallant explorer on his return from Alaska.

The introduction of small-pox, measles, typhoid, cholera, etc. into America is fully authenticated. It does not appear that a single important disease of parasitic type was common to the New and Old Worlds at the time of the discovery of America and its colonization by Europeans.

Other Correlations

The correlations briefly suggested in the preceding parts of this paper cover only a small number of those that might be made. For instance there are numerous cases of adaptation and invention which contribute to the proofs of inventive genius among ancient Americans. There is the preparation of bark cloth and paper, and the preparation of rubber from the coagulated latex of the Castilla elastica. This substance was made into balls for a special game. It was also used to tip drum sticks, to make capes and other parts of dress impervious to water, etc. Then there was the burning of limestone to make a mortar for architectural purposes. These all parallel developments in the Old World, but with a factor of originality.

But there are also notable absences. For instance, the wheel as a mechanical device appears nowhere in the New World.

Even an imperfect correlation emphasizes the inventiveness of man, and supports the logical position that the ancient Americans achieved by far the greater portion of their culture in the New World without occult help from the dominant civilization of the Old World.

A BRIEF INTERPRETATION OF FECHNER

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In an age of struggle between mathematical mechanism and mystical vitalism, it is natural that there should be many signs of reawakening interest in the work and vision of Fechner. For Fechner was probably even greater as a poet and as a mystic than he was as a psychologist, though probably the first great experimental psychologist, with clear-eyed mathematical attack upon a quantitative psychological problem. His living influence to-day is that of one who saw the significance of the work he undertook, who had a vision of the philosophical and social meaning of his problem and the experiments which bear his name.

Nothing could be more misleading than to study Fechner as a follower of Weber, as if he were simply an echo or a reflected light from the great physiologist. A moment's glance at Fechner's early life shows how soon his characteristic genius displayed itself. He started his career as a student of medicine, and of physics and chemistry, at Leipzig, where he began to give instruction a few years later in physics. He interested himself especially in contemporary discoveries in mechanics and electricity. His earliest writings, consisting of scientific treatises and translations from French experimental contributions, show how as a young man he mastered the physical science of his day. But he began before long a series of brief articles of purely literary design. Among these one of the purest gems is the *Little Book of Life After Death.* In this he strove to show how we are, as it were, all parts of one another, living in each other so fully that as long as human life continues, no individual can die. He was studying the philosophy of Fichte and Schelling also, and beginning to give literary expression to the feelings it kindled within him; and was very deeply stirred by the 'Philosophy of Nature', which was led by Oken, and dominated by the desire to find a spiritual meaning in all the events of the natural order.

The source of this many-sided distribution of interests was the problem: "How can quantitative science teach us to study the

human spirit in its relation to the universe? How can those exact methods which have been applied so successfully in the natural sciences be turned to advantage in the study of the inner world? How can we ever see the soul under conditions of direct and reportable observation?" As we are told in J. T. Merz's exquisite appreciation of Fechner:—

> "He became acquainted with the philosophy of Schelling, Oken, and Steffens, which dazzled him, touched the poetical and mystical side of his nature, and, though he hardly understood it, had a lasting influence on him. The simultaneous occupation with the best scientific literature of the day (he translated French text-books such as those of Biot and Thénard, and verified Ohm's law experimentally), however, forced upon him the sceptical reflection whether, 'of all the beautiful orderly connection of optical phenomena, so clearly expounded by Biot, anything could have been found out by Oken-Schelling's method?' This mixture of exact science and speculation, of faithfulness and loyalty to facts as well as to theory, runs through all Fechner's life, work, and writings."

It is easy to see why he was both a follower of the 'Philosophy of Nature' and one of its most ardent opponents. He did not come to this attitude hastily; he felt about for a way. He knew vaguely what it was that he sought, but there was no movement which undertook the thing he wanted, no school with which he could affiliate. Reaching in one direction and another, he was bewildered by the complexity of the spiritual heritage which came to him, and the futility of stating and cataloguing it in the terms of those sciences in which he was at home. He began then, in a series of satirical writings, under the name of Dr. Mises, to assert a negative expression of what he felt; he began to satirize mechanistic science. The attempt to bring the biological sciences into terms similar to those of mathematics and physics seemed to him to involve the repudiation of biology and psychology, because this attempt seemed to repudiate life and mind at the outset. The attempt to transfer the methods of physics and chemistry into biology and psychology meant for him a retreat from the self-evident world of life of which we are a part; it meant also the denial of the living reality of the whole universe, every fibre and atom of which was for him equally alive and meaningful.

From these satires it is apparent that he had not achieved in his own mind the first statement of his problem. He could not begin to solve his problem because he could not quite state it. He felt, on the one hand, the need of an exact method in order to make headway in biological and psychological science; but at the same time, the existing methods could never interpret the events which they recorded. While he groped about, satirizing

quantitative science under a pseudonym, he was at the same time carrying on exact research in the field of physics—was identified, for example, with investigations into the atomic theory. While teaching in the classroom the physics of the day, he was constantly trying to see a way in which satire could be replaced by a new understanding of the subject matter of science, an understanding which would make both the human soul and the objects which it knows equally accessible to methods by which real knowledge can be amassed.

During this period Fechner suffered from a progressively severe illness; perhaps it was the sort of illness that is now vaguely called a 'nervous breakdown'. He persisted in increasing his difficulties by undertaking the study of positive after-images from bright stimuli, particularly the sun. Violent pain in his eyes and partial blindness resulted, from which he did not recover for several years. The earlier disorder, complicated by the inability to read, and apparently even the inability to think clearly without great difficulty, caused something verging upon a collapse. His wife, however, brought him through this difficult time and he gradually recovered.

As the vigorous use of his mind returned to him, he began to ponder again on the relation of mental to physical processes, and the possibility of discovering a quantitative relation between them. One day the discovery burst upon him that there is one sort of quantitative relation observable in daily life, namely, that the intensity of sensation does not increase in a one-to-one correspondence with an increasing stimulus, but rather in an arithmetical series which may be contrasted with the geometrical series which characterizes the stimulus. If one bell is ringing, the addition of a second bell makes much more impression upon us than the addition of one bell to ten bells already ringing; if four or five candles are burning, the addition of another makes a scarcely distinguishable difference, while if it appeared with only two its psychic effect would be considerable. The effects of stimuli are not absolute, but relative; relative, that is, to the amount of sensation already existing. It occurred to him that for each sense modality there might be a certain relative increase in the stimulus which would always produce a certain intensification of the sensation; and this ratio would hold for the entire range through which the stimuli might be made to increase. We might say, for example, that sensations increase arithmetically according to a formula in which we need only to know the constants which determine the rate of geometrical progression for the different

sense modalities. This he stated as :

$$S=C \log R$$

where S is sensation, C is a constant for each of the different fields of sense, and R is the stimulus.

In this same period he published a sort of philosophy of nature of his own, entitled the *Zendavesta*, its title reflecting, of course, the general incursion of Oriental thought during the middle of the century. The Zoroastrian system, with its fundamental dualism in which good and evil centre in personal beings, laid hold upon Fechner's imagination; through it the world could be seen to be really personal, really alive. It absorbed Fechner partly because it made possible the personal interpretation of the natural world—a world not seen, however, as an antithesis between natural and supernatural, but natural and spiritual at once. This gave him the antithesis which he wanted to the science of his day; it gave not only man but the universe a soul, or rather a plurality of souls. In the *Zendavesta* Fechner mentioned casually that he had recently discovered a simple mathematical relation between the spiritual and the physical world.

For a decade he now undertook most assiduously a series of epoch-making experiments to test his hypothesis regarding the relation of sensation-intensities to stimulus-intensities. Immediately after beginning these he happened upon some work of Weber which had commenced a quarter-century before. Weber had shown that there appeared to be a definite law governing the relation between the intensities of stimulation and the ability to distinguish which of two stimuli was the greater; this he had stated in terms of the ' just noticeable difference ' between two stimuli. If thirty ounces can just be distinguished from twenty-nine ounces, sixty ounces can be distinguished, not from fifty-nine, but from fifty-eight ounces. That is to say, the ' just noticeable difference ' is a constant fraction of the smaller stimulus. This principle, laid down by Weber on the basis of work upon judgments of the length of lines and judgments of weights when lifted and when lying on the hand, seemed to be a mathematical generalization of great importance. Fechner saw its relation to his own hypothesis. He seized upon it, made much of it, and proceeded to extend enormously the experimental work to confirm it. But the difference between Fechner's hypothesis and Weber's is enormous. Weber had concerned himself with ' just noticeable differences ', but Fechner could only be satisfied with a mathematical statement of the relation of the physical to the spiritual world. Fechner had, of course, to use two supplementary hypotheses : first, that sensations can be measured (for example, three units of loudness), and second, that there is a

zero point for all sensations (leading to mathematical difficulties in handling the sensation when the stimulus decreases below the zero-point of the sensation). Both points were the subject of endless controversy, but both, as Fechner realized from the beginning, were essential to the very core of his purpose.

For in this measurement of sensation, as he explicitly stated over and over again, his one purpose was to find the quantitative relation of the objective to the subjective world. The longing which he had to find the meaning of the world in terms which would articulate with the scientific methods of his day, that is, to find the relation between the qualities of experience and the quantities of science—this was the thing which forced the treatment of qualities into the quantitative mould. If he laid a foundation for one vast subdivision of experimental psychology, seeking to confirm his law in as many fields and through as many methods as possible, it was in the service of a struggle to find confirmation for his mystical conviction. The magnitude of the man is shown not only by the elaborateness and ingenuity of the experimental approach, but by the patience and honesty with which errors and discrepancies, pitfalls and disappointments, were recognized.

When his *Elements of Psycho-Physics* was published, he was beginning to turn to other fields of investigation in a way that would tempt one to think that he pretended to finality. As a matter of fact, however, the work went on and on. Through his contact with Wundt and the latter's laboratory investigations and publications, Fechner was constantly occupying himself with the writing of new articles and with answering objections.

In this period, having now reached sixty, he began to concern himself with a more elaborate statement of his philosophical position, and in this he more satisfactorily worked out his ultimate view. This statement he called *The Day View Opposed to the Night View*, and in it we find a magnificent insistence upon the meaning and value of all the known universe, expressed with a lyrical beauty which moved William James many decades later to an outburst of enthusiastic welcome to a most kindred spirit. The universe, said Fechner, is an organism with articulate parts, living, and rejoicing in its living. Each of the stars and planets, each stone, each clod of earth, has its organization, and organization means life, and life means soul. Everything is imbued with a consciousness of itself and a response to the things about it. This view Fechner carried into the foundations of a system of philosophy which is as utterly and absolutely monistic as was the materialism of the nineteenth century, but as pantheistic as Hinduism. It is a far cry from this, to that contemporary parallelism which says

that mental processes and brain processes go on without relation like two trains following on tracks side by side. Fechner was assumed to be a parallelist; few took the trouble to understand him, and he has contributed, strangely enough, to the spread of parallelistic ideas in modern psychology. But for him the world had become one; the experience which men have as persons is of the very substance of the universe, all of which is throbbing with life and experience. This life we may, if we choose, study quantitatively; we may study it in the physical laboratory or in measuring the intensity of sensations.

Both experimentally and logically, therefore, Fechner's purpose seemed fulfilled. But he was not content, and, pushing forward to new worlds to conquer, he laid the foundations of the science of experimental æsthetics. Just as he had protested against the vague symbolism of the philosophy of nature, so he protested against the æsthetics 'from above' which undertook to lay down the principles of beauty from which the beauty of the individual object may be deduced. He began to measure books, cards, windows, and many such objects of daily use to find what quantitative relations of line are judged to be beautiful. He carried this into the study of the masterpieces of pictorial art, undertaking to find those linear relations which the artist has unconsciously used. This æsthetics 'from beneath' was to offer the same humble but endlessly careful approach to the problem of beauty which the psychophysics had offered toward the mind-body problem.

As little as in the psycho-physics, were his hopes destined to be fulfilled. Time has gratefully taken his methods and his data and gone on with them, to be sure, to a rich harvest. The problem, however, for which he sought a solution was not so easily met. Fechner's mystical grasp upon the unity of life and of the world, lives and seems to grow apace, not as an adjunct to an experimental problem, but as the fulfilment of both an intellectual and a spiritual need. It is to-day as if, in the white heat of his glowing personality, quantitative science and mystical intuition had become one; outside the flame of that personality the fusion will not take place, and the two stand starkly opposed to one another. Perhaps his was a synthesis more artificial than real; perhaps it was a synthesis which only the rarest metal can attain. The struggle which goes on to-day to find—after all in quantitative terms—the relation of the mystical to the natural world, is at any rate less agonized, more insightful, than it could have been without Fechner.

THE IMPORTANCE OF A STUDY OF SYMBOLS IN PSYCHIATRY

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Introductory

Psychology should be the science of the behaviour and thinking of organisms. Behaviour is integrated activity directed to the accomplishment of a more or less clearly foreseen end. Psychopathology should be the science of ineffective or harmful behaviour and thought.

While the history of psychology and instances of psychopathological phenomena extend backwards to the dawn of records, it is only recently that either discipline has been distinguished from philosophical procedures. The biological notion of man is responsible for the advance, and the psychology which has resulted is psychobiology. It teaches that man is distinguished from many lower forms of life by a peculiarly effective agency used in the adjustment of his organism and environment. It shows us that an explanation of maladjustment is to be found, not in the organism alone, nor in some transcendental region, but instead in the *creature in the midst of his situation.*

At about the same time, Dr. Adolf Meyer, and Drs. William A. White and Smith Ely Jelliffe elaborated the conception of mentation as the activity of symbols. Dr. Meyer wrote of this as a peculiarly efficient mode of vital response which has appeared as a biological advance in the case of some of those animals possessed of a central integrating apparatus. He discusses symbols " in the form of gestures, emotional display and language, and in their silent form " —thought. Drs. Jelliffe and White speak of the symbol as the type of tool at the psychic level : " In the phylogenetic history of that development which culminated in man, the symbol has been

developed after trying and laying aside in the past all other tools, because it alone offers the means of unlimited development of man's control over nature." They include "the conception that the symbol is a source and a carrier of energy", and stress "the importance of archaic symbols and their relationship to somatic as well as mental disease". Dr. Meyer states that symbols are built up "out of perceptive-cognitive-discriminative, and affective and conative assets". Drs. White and Jelliffe mention ideas and feelings as symbols. It will be appreciated that these usages are not to be confused with the notion of symbols as an occasional or at least a particular phenomenon of mental life. To the latter category belongs the usage of symbol by Jung. The popular usages of the term are very loose; it is vague, ambiguous, and shifting in meaning.

The Symbol

The extinction of the mind-body problem and the affiliation of psychology, not only with biology, but with all the sciences depends upon the conception of the symbol. Physiomorphic rehashing of psychological problems has failed. Physical chemistry, when it can penetrate into the vital colloidal phenomenology, may provide a more general conception. In the meanwhile we must elucidate our notion of the symbol if psychobiological consideration is to displace the sterile traditional psychology and the verbal theories.

In the higher mammals at least, among those organisms possessed of a centralized nervous system, we find an economical adjustive process which consists in the utilization of symbols in lieu of unmeaning realities. We speak of this (in the case of man alone, all too frequently) as mental life. The peculiar effect exerted upon us by our mode of behaviour in speech and graphic procedures, and by the implicit use of words and related signs in thought, leads readily to error. Such behaviour and thinking is an extremely important variation in the evolution of the mental, but it is far from being the distinguishing manifestation of symbol activity. The use of symbols is probably no more private to *homo sapiens* than is the utilization of locomotive apparatus.

As the present writer has elsewhere shown[1], the early development of the human young succeeds in some respects more in blunt spite of language than through its benevolent assistance. For that matter, in certain numbers of human beings the principal effective use of language combines the creation of destructive cultural media

[1] "Erogenous Maturation", *Psychoanalytic Review*, XIII, 1926, pp. 1–16 — a comment on sexual theory. See also "Peculiarity of Thought in Schizophrenia", *American Journal of Psychiatry*, V, 1925, pp. 21—87.

for their fellows (in a curiously mean contradistinction to the performances of any others in the animal kingdom), with an imbecile self-deception, which would so degrade the adaptive responses of a less protected animal as to lead promptly to its extinction.

Thorndike (*Psychological Review*, 1899) reported his observation of certain instinctive reactions of young chickens. He found that when first confronted with a situation in which the platform on which they stood was raised somewhat from the table-top, the adaptive behaviour varied within limits in direct relation to the distance by which they were elevated above the table. They would immediately jump down when this distance was small, but became hesitant when it reached a certain value. At a certain elevation, they no longer jumped.

The factor of previous experience was excluded from this experiment. As adaptive responses of the organism to concomitant environmental and autogenous situations, they demonstrated the effect of a curious something entering in a strikingly precise limiting relationship to behaviour in connection with visual and kinæsthetic experience. When the manifold of organism and perceived environment is not within the scope of a certain relation to this innate something (which we might in ourselves refer to as safe jumping distance) the adaptive behaviour was inhibited. We would generalize this by saying that the greater the discrepancy between the new experimental symbols relative to the environmental situation and a particular innate symbol or symbol-system, the less the manifestations of the innate factor in the shape of overt behaviour by the creature. At one point, behaviour proceeds almost as automatically as that of the yucca moth. At another, there is hesitation and apparent uncertainty suggestive of many of our deliberations. At yet another, behaviour suggests that the reaction of jumping down has no connection with the situation.

It is a fundamental property of living organisms to maintain indissoluble community with their physical environment. One may think that the symbol under discussion is some part of that environment incorporated (as is, e.g. oxygen) in some fashion into the organism. Such a view is obviously naïve. Continuous functional activity in and with the environment is another fundamental property. One may think that the symbol is a particular instance of that physiological activity. That it is a product of such activity, in a sense at least, we shall not contravert. But it is only when one considers the last of the triad of fundamental properties of living organisms that much light is shed on the nature of the symbol. Along with the properties of environmental community and physiology (functional activity), there goes invariably the factor of

morphology or organization. This property of all living organisms is exemplified by their relatively stable organization, after the pattern of their kind, the orderly progression of changes shown in growth, and the more rare phenomena of reorganization and variation.

No one could deny to such a something as the innate endowment of the chick, above referred to, a striking *stability*. No one who has devoted any thought to the relation of modification by learning to innate dispositions, instincts, etc. will deny to them, however variable they may be in one and another representative of the species, a marked stability. All these, as already suggested, will be covered by our use of the term symbol. Finally, no one can deny to ' an idea '—one of his notions—a distinct relative stability. A ' feeling', too, even if transitory, is apt to seem peculiarly *determinate*; as a mood, it may show remarkable stability. One hopes and expects of his ' acts of will ' no inconsiderable stability. All in all, it seems, there can be little doubt that a psychobiological symbol, whatever it may be exactly, shows strikingly this general biologic property of organization; not alone in its relatively persistent characteristics subsumed in stability, but also in the implied reorganization tendencies. Its occasional manifestation of variation will finally concern us.

In considering the general property of organization, we encounter not a continuing change as exemplified by the first two fundamental properties, but a *relatively* static phenomenon. It must be evident that the symbol of our discussion has no autonomous existence; that, analogously to a body-cell, it requires a communal ' mental ' or symbolic environment. It must finally be admitted that the symbol maintains unceasing, if widely variable (quantitatively or even qualitatively), functional activity.

The contrasting of the persistent with the changing is characterization in the dimension of *time*. When such a reference is added in our consideration, we enter into the realm of *events*.[1]

It is here that we first find a coherent view of life-processes possible. It is likewise by regard of the *temporal* reference that we can bring our concept of the symbol into a measure of lucidity. Immediately, from this viewpoint, two remarkable correlations appear: the organism is a quasi-autonomous event (or series of events), and the psychobiological symbol must be a generically identical event. But events of the latter category are not to be

[1] All our impressions of reality pertain in fact, to events. Any ' matter ' or energy collected in some area of space must ' exist ' there for some time, if we are to perceive anything.

envisaged merely in the simple relation of a part to the whole of one of the former category. The event which constitutes each symbol must be distinguished from all other types of events by its peculiar and characteristic relation to some non-symbolic event.[1] The peculiar and characteristic relation to which reference is made, is the relation of an *abstract* to its reality.

At the risk of verbosity I shall strive to show what precisely is connoted by the relationship of abstraction. Take for illustration a phenomenon of visual perception, what one 'sees' if he looks at a horse-shoe nailed above a cottage door. There is, let us say, an initial constellation of the horse-shoe upon or against a ground representative of the wood, vaguely combined with more or less of the neighbouring doorway, walls, etc. This constellation grows in richness as the ground takes on more and more characteristics real or analogous of 'cottage', and as the combination gains 'meaning' from cultural characteristics of the horse-shoe as a 'sign of good luck' in folk-parlance. (One may look upon the later stages of this series as representing a constellation of the relatively simple perception on or against a ground representative of related symbols 'in the mind' of the perceiver.) In so far as the symbol or symbol-system which ensues in this stream of experience is made up of *characteristics* simply (but mediately) related to the real object and its real medium (the horse-shoe and building), it is a relatively simple 'cognitive' abstraction of the same genera as 'noticing' the redness of a rose or the odour of a carnation. It is a (really marvellously complex, but seemingly) simple primary phenomenon in the symbolic realm pertaining to our interaction with the environment. That which is abstracted is a group of characteristics of the 'external' event. Which characteristics of this event shall be abstracted, depends upon the previous experience of the individual (visual-neurophysiological factors remaining constant). A blacksmith may 'notice' the type, apparent condition of use, and so forth, of the shoe, or the incongruity of the type of nails used to fasten it. What the photographer would 'notice' might be the shadows thrown on the background, the illumination of the unusual nail-holes, and so forth. What the folk-lore expert would 'notice' on the other hand, would include few of these 'simple' characteristics.

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[1] It will be noted that this implies a classification of events in three divisions (which are, seemingly, valid divisions in the sense of mutual exclusiveness) :—

(1) Non-symbolic events pertaining to living organisms and their constituent living parts;
(2) Symbolic events (which must pertain to *a* living organism) ;
(3) All other events which occur in the universe—a vast category of the inorganic not in immediate relation to a living organism (and more specifically for our present discussion, not in at least closely mediate relation to *the* organism in question).

In so far as the symbol-system of this experience seems made up of characteristics *immediately* related to 'experience of another time', the relation of abstraction is of a more complex or higher order. Throughout the realm of experience pertaining to sensory excitations, however, there is always this peculiar and characteristic relation of the symbol-system to a reality which is or has been constituted by interaction either (1) between the individual organism and its physical environment, or (2) the individual and his cultural (symbolic-physical) environment; the relation, to wit, of a quasi-autonomous event made up of (a) some greater or smaller number of characteristics of the event which included the organism-and-environment interaction referred to, and (b) some greater or smaller number of characteristics of the pre-existing symbol systems of the organism.

It must be evident at this juncture that the most elementary symbols are events constituted by 'simple' characteristics; in other words, a distinguishing attribute of the other event of interaction which it symbolizes.[1]

In considering the relation of abstraction, however, one is apt to overlook the 'place' of the event abstracted. So important a part do our 'distance receptors' play in the evolution of 'common sense' that one falls easily into the error of supposing that he directly 'experiences events at a distance'. Many of the alleged problems of psychology have arisen from confusions pertaining to (1) the real 'object perceived', (2) the *act* of perception, and (3) the 'percept'. A highly sophisticated philosophy has gone to the extreme of denying the actuality of the first member in this division. It insists, in its various forms, against our having any external realities; and holds that the 'outer world' of common sense is but the projection of purely mental material, perhaps in the end, to some extent the mental content of a Master Mind. All these questions arising in connection with the identity (insisted or resisted) of the 'object perceived' with 'the percept', can be laid at rest by noting the second member in our division. With the act of perception standing as the mediator, it is inconceivable that the 'object perceived' (if the expression has a particular meaning) and the 'percept' (in any meaningful sense) should be *simply identical.* The notion, however, that the third member is a synthetic abstraction of the first, secured by the complex potentialities and processes implied in the second member, is lucid. Keeping in mind (I) that it is not

[1] It is hoped that the principally 'cognitive' considerations which have made up this discussion will not becloud the issues later to be presented. It is necessary in order to achieve any degree of lucidity, to begin with the commonplace and lead into the other phases as its limitations become obvious.

the tree some hundred yards away that activates one's receptors, but instead certain physical phenomena ' resulting ' from (a) the existence of the tree, (b) the existence of a medium between the tree and our receptors, and (c) the occurrence of specific physical phenomena throughout the medium between our receptors and the tree; recalling (II) that our ' perception ' of the tree depends not alone on these ' outer realities ' but also on (i) the specific character, and (ii) the functional activity of our receptors, together with (iii) the integrative apparatus which in many cases co-ordinates the influx from several receptor fields; minding also that (III) the completion of the ' act of perception ' involves remarkable *relational* processes mediating between (α) that which the integrative apparatus ' presents ' in the immediate consciousness—sentience of the momement, and (β) the ' presentation', or representation of past experience; one cannot, it seems, avoid an appreciation (in cognitive procedures) of *sentience* relatively simply related to functional activities of the integrative apparatus developing into cognitive material relatively simply related to the organism as a whole—past, present, and immediately future (in so far at least, as perception of the present aids or determines the behaviour of the immediate future).

While all these considerations have engaged the attention of many, there are still to be discussed other features of the ' place ' of the events which we abstract in ' forming ' symbols. The analysis first outlined leaves us with an external reality, various receptive processes, and an ' inner ' perception. The physicist could use his data and instruments to ' identify the reality', even to successful prophecy as to possible interreactions with it which we might bring about. The neuro-physiologist could interpret in more or less biochemical terms, what was transpiring in our receptors and integrative apparatus. The student of cognitive processes, e.g. Professor C. Spearman, could show us by what processes our notions of this particular ' external reality ' grew from elementary sentience to its terminus in more or less marvellous information. But nowhere in these procedures would we receive clear warning that they are all studies of part-aspects of the process of abstraction—entirely legitimate but incomplete views of the event, the symbol. If, for example, a schizophrenic companion, focusing a presumably identical bundle of light waves, determines to his satisfaction that he is ' perceiving ' instead of a tree, a gigantic woman with arms extended and hair wide-flung to the breeze, the physicist must conclude that the individual is insane; the neuro-physiologist, that he has disease or malfunction of the integrative apparatus; and the psychologist of cognition, that the study of illusion is in need of much development. If now, our schizophrenic friend rids

himself of the troublesome woman by hiring someone to chop down the tree, saw it into appropriate lengths, split them, and sell them as stove-wood—yet still insists that the tree was the afore-mentioned woman—then, amongst other things, (I suppose) the neo-behaviourist would feel justified in his contempt for experiential report. Certainly there is a discrepancy between the ' vocal behaviour ' and the ensuing purposeful behaviour. This discrepancy implies that there are things in ' subvocal response ' not dreamed of in the neo-behaviourist philosophy. And when the small boy's ' response ' to the presumably identical bundle of light waves is climbing the tree, in spite of a threatened spanking; the photographer's, a meditation on the optimum hour of illumination; the biologist's, a disquisition on genotypes; the psychoanalyst's, a statement concerning phallic symbols; the realtor's, a calculation as to how he can turn the landscape into fabulous profits; in view of such diverse reactions, one cannot but realize that the symbol activities of which the tree was at root are not only strikingly private to the individual, but in fact pertain enormously more to the individual than to the tree. It must be evident that the relation to external reality is confined utterly to the ' zone of interaction ' with the individual's personality. (The term 'personality ' is used loosely to sum up the entire basis of thinking and behaviour, provided by innate distinctions and acquired experience). Pending a fuller development of the topic in our discussion of projection, it may be agreed that the events making up symbols are occurrences which have their ' material location ' entirely *within* the organism. They *do not* include concatenation of events exterior to the physical confines of the body; but only purely autogenous ' data', the results of the communal existence of the creature and his environment.

This consideration of the ' place ' of the symbol, when correlated with the unity of the organism[1] should lead to an appreciation of the ' extent ' of the symbolic event. It is inconceivable, a priori, that such events would be simply *representative* of external reality. Comparative psychological observations and the meagre data of genetic psychology indicate no need for doubting the a priori

[1] It is essential that one rid himself of notions of relatively independent afferent, central, and efferent divisions of the cerebrospinal nervous system, on the one hand, and of functionally independent vegetative systems. An ' occurrence in an end-organ ' cannot be envisaged as other than an event throughout the whole organism. The implications of this conception are of the first importance. If one does not lose sight of physical *threshold values* in connection with sensory activities, he correctly assumes that this conception implies a *symbolic event* ensuing in connection with every stimulation of an end-organ. How this conclusion tallies with the facts of manifest consciousness will appear later.

impression. The more purely cognitive feature of symbolic events is a late stage in the elaboration of symbols.

The abstractions from the events constituting the organisms interaction with the environment, include (1) the factors derived from the physical situation itself, this being both the total vital situation and the particular situation of those parts peculiarly involved in the interaction (stimulated areas); (2) others derived from the inherent or acquired adaptive responses, including preparatory and executive steps; and (3) still others derived from the concomitant variations from the first group. Since these categories include the commonly accepted substrate of what we ' perceive ' as affective and as conative aspects of the mental life, it is seen that the ' cause ' of these latter contents in awareness is an essential part of the symbolic event.[1]

We therefore assume, subject to the general contingency of a scientific hypothesis, that the symbol is an event constituting an abstraction of physiological and morphological events in the organism, and of biological events including the organism and its environment; that the first of these categories may give rise to symbolic events comparatively intimate in their relation, but that the symbolizations relative to the second category are always mediate and frequently of a high order of abstraction. Furthermore, we assume that the symbolic events are invariably abstractive, in a relatively simple fashion, of the organism's total response in each of the events symbolized. With this hypothesis in mind, one realizes the present futility of attempts at describing a symbol in terms other than functional biological ones. It seems needless to emphasize the practical impossibility of ' becoming aware ' of an en tire symbolic event.[2]

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[1] One now begins to see the psychobiological situation underlying the phenomena discussed as ' kinæsthetic imagery', ' visual imagery', ' auditory imagery', and so forth. From category (1) comes an element pertaining to the stimulated area. The importance of the light-receptors in the acquisition of information about the outer world, would in the course of affairs, other factors not interfering, bring about an extensive element of the visual in the symbolic series. Symbol activities would therefore evidence much of what is connoted by reference to ' visual imagery'. Another probably more important factor in this connection will appear in our discussion of substitutive responses.

[2] This last mentioned contention carries with it much implication in connection with current philosophical doctrines. In so far as our development of the series of symbolic events implies elements in them which actually expend the possibility of cognition, and this *in cases, even, when the events are prevailingly of the mode resulting in ' sensory content'*, our view does not seem to coincide entirely with any popular philosophical viewpoint. It will appear later that if the symbolic events *in toto* are discussed as ' the mental', then that term takes on a meaning quite different in some respects from its ' commonsense ' connotation.

The Individual Sense

As the mutual and consecutive function of morphology determiners are necessary for the successful elaboration of the organism, so the integration of symbols and symbol-systems is essential to the evolution of a successful personality. Adaptation in man depends upon his ability for adjustment to situations. This is the functional activity of the personality. Determiners reflected in the innate constitution, the inherent dispositions, and in simple reflex mechanisms of the body may be important in a study of man, but they are secondary in the study of an individual. They are the first units in a lengthening series of symbolic events constituted in the manner already discussed. The series itself culminates in the personality of the moment. It and its constituents are unique. The individual may be considered in regard to his likeness to others, or on the basis of his specific differences from one or more others. To achieve an understanding of him, however, we must have recourse to study of his experience—the symbolic events which ensue from other events in which he participates.

In the simplest adjustments, however, there seem both less and more than biological and physical events should have provided. This seeming discrepancy originates from the incorporation in each individual series, each personality, of a great many cultural symbols. These are derived entirely from events including other persons. Furthermore, they are symbolic events of a considerable order of abstraction from the concrete physical realities. Such an event, for example, as a blow from an enemy, provides not only symbols of the injury, the injuring person, and the simpler features of the situation, but also symbols commonly referred to such entities as self-esteem, the opinion of others, the right of a citizen, law, order, and justice. So great is the cultural element entering into such a situation that the elaboration of its symbols is usually seriously distorted from reflecting the simple situation; for example, the information which the injured man can give is of decidedly indirect value in securing a correct report of the event.

When we study what is occurring in such a case, we discover the presence of *elaborate fictions*, the functional activity of symbols far removed from simple relationship to biological and plain physical events. In all likelihood we find that the situation is entirely meaningless from a crude biological standpoint. The 'enemy' wants nothing which the victim can give, he is not obstructed, threatened, or thwarted by the other, nor does his behaviour of attack secure him anything which satisfies his simple biological needs. All too often, his act of violence causes him increased

difficulties and actually puts him somewhat in jeopardy. Yet, unless we accept a transcendental factor, we must assume that the behaviour can have been nothing but the necessary outcome of his interaction with the particular environment, including the injured one. The interpretation of such paradoxical reactions involves that symbol-system to which Shand has referred under headings of the self-regarding sentiment, " the great principle of self-love", and the sentiments of self-respect, and respect for others.

By *sentiment*, we designate a conception designed to explain the motivation of behaviour and thinking pertaining to a particular object. The nucleus of the personality, so to speak, is the *sentiment of self*. Any unaccustomed interaction with the environment is likely to provide experience bearing on that particular sort of event. The experience has, of course, material reference to the experiencer. From the cognitive side, it may be said to pertain to the self, or to consist of knowledge or belief about the self and the particular environmental manifold of the moment. In so far as it pertains to the self it is incorporated into the growing system which we name the sentiment of self. By this is meant that it leads to a more or less marked alteration in motivation of thinking and behaviour about the self—to more or less marked changes in these manifestations of the innate and acquired dispositions of the organism. If the other participants in the event from which the experience arose are inanimate objects, there is generally no result other than this addition to the sentiment of self, and the individual has what he describes as information about something.

When, however, the event includes interaction with another person, and particularly when this person by accident or design interacts frequently with the experiencer, the symbols arising therefrom tend to assume a special configuration in the individual series, and to form a sentiment pertaining to the other person, whom we call the object of the sentiment. It must not be thought that these symbols which are incorporated in a sentiment other than that of self are combined in an independent system. Such is never the case in the integrated personality. Symbols normally fall into various constellations in a single discrete series (to which I have referred as the time-mnemic series, and to which we herein refer as the personality). A crude simile may help to clarify the notions of sentiment of self and sentiments pertaining to others. Instead of thinking of a growth somewhat like that of a tree with branches departing widely from a central trunk, let us imagine the building of a hollow cylinder from blocks of many different sizes and colours. One at a time is added, but each of a certain colour to be piled on its own colour. If a uniform mixture of many

colours and sizes is provided, the building will approximate a cylinder. If all of one colour be very small, there will be a gap in that colour. If blocks of one colour are very numerous, there will be an excessive development in that colour. As the building proceeds, however, there will appear vertical bands and spots analogous (in the whole) to the organized sentiments. The growing cylinder will represent a static conception of the personality. If now we picture the blocks as of transparent media of various refractive indices, and the cylinder as resting upon a powerful source of light, the distribution and colouring of the light which escapes through the uppermost blocks of the bands and spots will be remotely analogous to motivation as influenced by the sentiments.[1]

In this analogy the sentiment of self is built of those units forming the matrix of the special sentiments and also of the sentiments themselves *as units*.

These sentiments pertaining to others (friends, enemies, one's children, ideals, objects of art, pets, etc.) manifest themselves by an influence on behaviour and thinking concerning the object, which renders such mental activity more or less distinct from the general adjustive tendencies of the personality—which are in turn the manifestation of the sentiment of self.

The *object of a sentiment* must not be assumed to be a concrete physical reality. The object is not external but is simply the cognitive aspect peculiar to the sentiment. With the growth of the sentiment by accretion of symbols to its system, there goes a growth in richness of characteristics of the object. Were it not for the extraconscious character of many symbols, this growth would be evidently parallel.

The more strong the influence of sentiment, that is, the more powerful its conative aspect, its modifying effect on an innate or more early acquired urge, the greater the dynamic situation between its constellation and the sentiment of self, and the more a certain complex element enters into its cognitive aspects. By this, I refer to the manifested effects of symbol *cadres* within the sentiment of self.

It will be recalled that Shand found occasion for delineating three separate sentiments which we combine in the one. McDougall, having abstracted two principles to which he refers as the self-assertive and the submissive instincts, combines them in the

[1] In this unsafe analogy, the size and colour by reflected light of the blocks may be taken as cognitive aspects, the light itself as the vital energy, the colour imparted by the blocks in its transmission as the affective aspect, and the specific deviation in the light rays brought about by their transit through the blocks as the conative aspects, respectively, of symbols. To end the analogy, the blocks would not represent symbols until each was in its place.

sentiment of self-regard. The situation as seen by the psychoanalysts is not so clearly stated but equally implies a complexity which they see manifested in ambivalence. When one studies the peculiar attitudes towards self which are manifested by patients suffering schizophrenic illnesses, he observes facts which do not co-ordinate with any one of these views.[1] Search for the simplest hypothesis which does justice to all the facts has led us to the view that certain relatively distinctive tendencies within the personality are to be accounted for by reference to primitive experience. Psychiatry thus rests upon the study of the origin, growth, and manifestations of symbols, and this study begins with the first events in which the organism functions as an integrated whole.

[1] MacDougall's notions about schizophrenia, as expressed in the *Outline of Abnormal Psychology*, cannot but disappoint anyone who deals with such patients. To describe them as incomplete is unmerited praise. He may have built a theory which has a bearing on that state called by Kraepelin *simple dementia precox*, but he has certainly missed—excepting in uncorrelated matter quoted from others, with or without credit—the essential features of the common disorder

A MODERN RALEIGH

By CONSTANCE LINDSAY SKINNER

When that great writer and explorer, Sir Walter Raleigh, said "We may gather out of history a policy no less wise than eternal," he made apt choice of mood and tense. Experienced in defeat, Raleigh apparently had concluded that ignorance of history on the part of sovereigns and people was largely the reason why he had lacked consistent intelligent support in his efforts to extend and to make secure the frontiers of his island home. He had tried to open the way for a greater and safer England with the soldier's sword and the colonist's axe. Now he took up the pen, realizing at last that there is neither greatness not safety for the uninstructed. He began to write a History of the World, not merely a History of England. The England of Raleigh's dream was not backgrounded only by one island's past. Some Englishmen, including sovereigns, knew the date of the Norman Conquest, though they had forgotten how and why the blonde hordes, of which the Normans were a branch, had spilled down out of the North. They knew something, if only from ballads, about the civil Wars of the Roses. But what did they know of ancient empires that crumbled and of cultures that passed because parochial-minded senators drowsed in the capital and sentinel boxes on the northern frontier stood empty? What did they know of Babylon falling before the descending Persians; of the democracy of Greece shattered by the Macedonian Northmen; of the downward push of Goths and Huns; and even of Europe, so much more recently, quaking at its center from the tramp of the Tartars? There was at least the hope, thought Raleigh, that out of the study of history his countrymen would seize at last upon his vision of an England whose frontiers never left the path of the sun, the vision which his life and the gallant death of his step-brother and spiritual comrade, Sir Humphrey Gilbert, alike had failed to give them. He began his History while in the Tower under sentence of death, and he never finished it. The record of the crimes for which Raleigh lost his head omits to mention the chief one, namely, that he had tried to make his King and his people think—lese-majesty on the one hand and, on the other,

VILHJALMUR STEFANSSON

menacing the public morals! It is one of the little ironies of history that King James did so much to make Raleigh's vision a reality, not with any such intent, but merely to 'harry out of the kingdom' groups of his subjects who disagreed with his theology. From the far western centers where those groups planted themselves, their descendants, through colonization and through conquest, spread northward to the Arctic Ocean. The last frontier protecting that form of civilization and culture developed by the English-speaking peoples is a line of islands across the top of the western hemisphere.

That dotted frontier line, as both a geographical expression and an historical symbol, has inspired Vilhjalmur Stefansson to repeat two of Raleigh's experiments. Whether these experiments will later bring Stefansson into the obloquy which in our time supplants the headsman's block remains to be seen. Such a development is not unlikely, since, to quote Raleigh again, "it is Opinion, and not Truth, which travels this world without a passport." For a dozen years or so, Stefansson has continuously challenged people to think. He has pleaded with them to bestir themselves to make use of the riches of the North, and to gather out of history that policy with regard to the Northern Frontier which is no less wise than eternal. And he has planted two colonies. The parallel with Raleigh runs fairly close, too, as to the fate of his colonies. One perished. The second was carried off by the naval vessel of a country which considered a British settlement an interloper on those shores.

Stefansson, by blood as well as through his signal achievements as an Arctic explorer, is a product of that land whence trouble comes, the Northern Frontier. He was born some forty years ago in Manitoba, which was 'north' in those days. He is of Icelandic parentage, and is therefore a descendant of those Norsemen whose ravages inspired Alfred to build the first English navy (if only as a prophecy of greatness to come by the sea), and whose intrepid curiosity sent them scouting about the shores of North America to cut timber and plant settlements five hundred years before Columbus peered vainly across the harbors of Cuba for the royal junk of the Great Khan. This racial element is stressed by Professor Ellsworth Huntington of Yale in his recent book, *The Character of Races*. He describes Icelanders as "cautious, careful, level-headed, and at the same time quick, alert, and strong, able to co-operate with their fellows, resourceful, observant of winds and waves, and able quickly to draw conclusions in the face of danger and death." And he goes on to say, "Read a book like Stefansson's *The Friendly Arctic*. There one sees a concrete picture of those

qualities and their results. In the whole realm of exploration few books exemplify a greater capacity for careful accurate observation, for caution combined with daring, and for correct inferences from natural phenomena."

There is certainly in Stefansson that blend of daring, self-confidence, energy, genius, and imagination which made the Norsemen so successful as warriors, sailors, and as colonizers. The Norsemen were the first mariners to anchor their ships with prows toward the outer sea. They were free-minded men, sceptical regarding some ancient conventions about ships and salt water. Stefansson was sceptical about the traditional picture of the Arctic as an ice-bound region washed by an ocean 'without life', and where white men could not live, where in fact white men had no reason to go except as a courageous stunt, challenging certain hardship and a death almost as sure. He reasoned, as he once told the writer, that "of the ten deadly perils of the Arctic, nine were imaginary." Having uncovered the fallacy of the nine by analysis before he sailed north, he never encountered them. "And your exercise of intelligence in getting rid of the nine imaginary perils equips you to deal with the tenth, the one that *is* real." Out of the same reasoning, plus experience, came two of the Stefanssonion axioms regarding those much abused words 'Adventure' and 'Heroism', which are popularly quoted by his friends: "A dangerous adventure is a sign of incompetence," and "Whatever you add to an explorer's heroism you have to subtract from his intelligence." He went North, "determined not to be a hero if I could help it."

This, unmistakably, is not the speech of an Elizabethan! In Stefansson we find less of patriotic passion, more of the passion for science, than in Raleigh; not less of poetry—both have written verses—but there is a different color and form to the world of Stefansson's poetic vision. As a prose writer, at his best, he outranks Raleigh and most of his own contemporaries. *The Friendly Arctic* is not only a compendium of iconoclastic truths about the North, of incisive descriptions of the country, and of revelations of the massive yet flexible mind of a man extraordinarily equipped by Nature for his task; it is a literary masterpiece. His wit and his biting irony would have made him at home in Raleigh's circle. His inability to apply the science of mathematics to his own money, his reckless generosity, his sense of responsibility (or it may be merely a kindness of heart towards all those who have ever been on the trail with him, which leads him to renew associations and to forget treacheries) would have ruined him long since but for firstly, his tremendous industry permitting his funds to keep pace with his

charities, and secondly, his indomitable if somewhat sardonic sense of humor which enables him to extract an invigorating elixer out of a poisonous stab in the back.

Stefansson spent a dozen years in the Canadian Arctic. As if in defiance of epigram, those years registered both hazard and heroism, but their most profitable result to the civilized world was in the changed concept of the Arctic which Stefansson offered to the consideration of science and commerce. He replaced a false tradition which was useless, save for emotional purposes, with a truth which is workable. Among the revelations proceeding out of Stefansson's scientific labors in the Arctic there are two of tremendous and immediate importance to the 'man in the street'. The 'man in the street' is carnivorous; and, year by year, the increase of population and the spread of towns are decreasing, and swiftly, the area and product of the North American cattle ranges. The 'man in the street', the farmer in the field, the captain of industry, and the legislator in the capital pursue their vocations to fruition primarily because their frontiers are guarded; to the south by army posts, east and west by navies, north by an enormous region of ice. But the last named protection Stefansson has exposed as a myth. In pointing out to Canadians and Americans that the Canadian Arctic regions, mainland and islands, comprise a vast pasture land to which they must soon look for a large part of their meat supply, and that intelligence disposes of most of the hardships of life there (even as it disposed of the hardships of the earlier frontiers of this continent) Stefansson has inevitably drawn the attention of other nations and races to that unguarded northern border and to the accessibility of the riches that lie south of it. The profligate abundance enjoyed by near neighbors still inspires the sentiment that was in the breast of Francis I when he remarked to a courtier, apropos of the voyage on which Cartier was setting out, "God has not created those lands solely for Castilians!"

The parish mind has a well-defined prejudice against those who commit the crime for which Raleigh perished. Stefansson, too, found that it did not want to think about the Northern Frontier. Possibly he believed that if he waited till it was willing to think about it there would be no Northern Frontier to guard, at least by the nation this side of it. He planted a colony on Wrangel Island, and two years later sent more men to augment it. The story of this undertaking is fully told in his latest book, *The Adventures of Wrangel Island;* and his ideas, the vision, and the historical studies which prompted him to that adventure, are well set forth in *The Northward Course of Empire*—in one or two respects the most significant of his published works. The failure of his enter-

prise through the death by disease and accident of the first colony, and through the seizure of the second by the Soviet, has unfortunately caused the unthinking majority to revert to the old and ruinous fiction about the North as an ice-bound, uninhabitable place, commercially worthless, and deadly to man—so much so, indeed, that no menace is to be apprehended by way of it. Perhaps that was the view of the curled Babylonian lolling by his lotus pool while Persian 'Rough Riders' marshalled along the Oxus. It was evidently not the opinion of the Russians who seized Wrangel, less because of its furs and ivory, than because of its suitability as an air base. History plays no favorites, and the English-speaking peoples may lose their dominion on this continent even as they won it, that is, through the old fiction about the North.

It will at least provoke thought to glance at a report prepared for Philip II of Spain in 1561 by one Villafane. In brief the sum of it was that, "We have abandoned attempts to colonize this desolate and inhospitable region which is incapable of sustaining the life of civilized men." The desolate and inhospitable region referred to is the one we know under the name of Georgia and the Carolinas. Surely, thought Philip, where Spanish civilization, the only civilization then crowned with the glory of American colonization, could not thrive, no novice such as English or French would essay to plant itself. Philip did not garrison Georgia and the Carolinas in 1561, and so failed to shut the door against the English, a power hostile to Spain, and with a language, a culture, an idealism, and a national consciousness alien to hers and to all her traditions. Two hundred years later the English held the whole Atlantic coast, including Canada; and in another seventy-five years their American descendants had entered San Francisco and hauled down the last Spanish flag waving on the continent. Philip's error immersed his own nation in centuries of twilight and changed the destiny of North America.

One of the clearest lessons of history, proved again in Stefansson's experience, is that Northern lands are inhospitable only to the stupid and the fearful, and are incapable of supporting only those whose inflexible concept of civilized life prevents them from intelligently adapting themselves to new conditions. Another lesson is that most people not only believe that the lands north are fatal to civilized life and therefore valueless, but that these same people are blind to the changes taking place in their civilization in its southern strongholds through the increasing application of recent inventions. Few people speculate about the influence of the airship upon civilization—even fifty years hence. Still fewer realize what Stefansson has been pointing out for five years; namely, that the

'short route' between Europe and Asia, sought by the sea-dogs of several nations through centuries of bold adventuring, lies through the unobstructed air over the polar regions—though Amundsen's flight has probably made some of them think about it for a few days. The airplane may influence civilization in its southern strongholds *most* by this one fact, that it will draw into close proximity with each other and with the southlands the farthest northern frontier lines of the eastern and western hemispheres. The civilization of peoples alien from each other in language, culture, ideals, and not only national but racial consciousness, will be in much closer contact, or conflict, than were Spanish and English civilizations in America in 1607; and Tokyo and Peking be nearer to New York than was Jamestown to the homeward route of the galleons from Vera Cruz. The airplane may well represent an attachment on the machine of progress which folds the edges of the frontiers under and whips them together in a seam—with all of advantage and of peril which that may entail. In those days of the near future the ownership and occupancy of that irregular dotted frontier line of Arctic islands will be of vital importance to the United States and Canada and to the type of civilization and culture which they uphold on this continent, wedged in—as they will be then—between a Latin-American culture to the south, welded into union and power by a common tongue, a common temperament, a common desire, and commercial development, and an Asia rousing from its thousand years sleep in conservatism to look for a larger place in the sun with all the will and energy of Genghis Khan, and with facilities undreamed-of by him. How slender appears that belt of Anglo-Saxon culture when one studies Stefansson's map on which he has divided the world, not into eastern and western, but into northern and southern hemispheres! Canada and the United States together are only a narrow band on the northern hemisphere—like a ribbon of wheat from the parent field drifted between old sturdy hedges of alien and inimical growth.

A third lesson to be learned from the long history of the human race in its push westward and northward is that men will find a way to go where they want to go, though that way lead across realms of ice, or under as well as over the surface of seas, or into the ethereal kingdom of the eagle; and that, when the end of a superstition comes, it comes suddenly. It took Prince Henry, the Navigator, only twelve years to disprove the superstitions about the Sea of Darkness and the flat world which had kept Christian mariners fearfully hugging the coasts of Europe for centuries. A free sea and a round world opened the way for the

voyage of Columbus. As to flying, man tried futilely for a thousand years to transport his body whither his imagination had already gone. The Wright brothers finally did it, and now, only twenty years after Kitty Hawk, the airplane is so little a matter for wonder that the 'man in the street' no longer stops to look up when he hears its whir above him. And he thinks as little about the future of flying as the average Spaniard thought about the future of the lands unveiled by Columbus.

Those who make the fate of Stefansson's first colony on Wrangel an excuse for re-echoing the old cry about "desolate and inhospitable regions incapable of sustaining the life of civilized men", forget that the Spaniards made several futile efforts during thirty years to settle the Carolinas. They forget the fate of Raleigh's colonies. They ignore the fact that of the hundred and four colonists who landed in Jamestown in 1607, less than fifty lived to greet the first snows; that of the hundred and two who landed at Plymouth in 1620 not half outlived the first winter. This is a toll of death from disease—in places long since praised for their happy climate and their other benefits to man—which was not equalled by Dawson, Skaguay, and Nome together in the first year of the gold rush, when southern born men grappled with degrees of cold and of hardship unknown in Massachusetts and Virginia. So far from attacking life, the North fosters life, by stinging all a man's energies into circulation.

Philip's lack of foresight and his Admiral's preference for a tropical climate lost a continent for Spain. The English gained it, not through James's foresight but largely as an accidental by-product of his intolerance. While history repeats its sober lessons with a patient, a tireless, reiteration, it very seldom, perhaps never, repeats its best jokes.

THE STANDARDIZATION OF ERROR

By VILHJALMUR STEFANSSON

I

It is said that Bacon considered all knowledge his province. But the sciences of to-day are so many and complex that a single Baconian view of them is no longer possible, and perversions of thought and action result because our intellectual horizon has been narrowed to a part of the field. From a realization of this have come various attempts to co-ordinate the sciences to permit a unifying view of the whole. The French philosopher, Comte, made one of these a century ago in his Positive Philosophy. There have been many since.

But if we pause to state clearly the case against the standardization of knowledge, the essential absurdity becomes so patent that we have to recall the numerous failures to convince ourselves that anyone was ever foolish enough even to try it.

Consider for instance the physiology of the human skin or the composition of a dust nebula. In these fields, among others, the accepted facts of a dozen years ago have become the error and folk-lore of to-day. You standardize knowledge, and while you are at the job the knowledge changes. Long before the thing can be adequately done it has ceased being worth doing at all.

Then why are we continually attempting this hopeless task? Partly, let us say, from irrepressible human optimism, which leads us to think that any desirable thing is possible. Partly, also, because of unclear analogizing from fields that seem related but are not. One of these analogies is from business. If you have on hand, on July 1st, a pair of socks, you will have them still on hand on August 1st, or else cash in your till to correspond, assuming honest and successful management. But, in spite of unlimited honesty and efficiency, you have no guarantee that an idea on hand on July 1st may not have been simply removed by August 1st without any equivalent remaining on hand. You may have discovered that month, for instance, reasonable assurance that the moon is *not* made of green cheese, without being able to get any clear idea as to what it *is* made of.

The reader may here jump at the conclusion that we are arriving at a philosophy of pessimistic hopelessness. That is not the way

of the true philosopher. His ideal is the *tabula rasa*. He sweeps away the systems of others, that he may build his own on a smooth foundation.

Realizing simultaneously the insatiable craving of the human mind for order and the impossibility of bringing order into the chaos of knowledge, we appear to be faced with a dilemma no less distressing than insoluble. But on looking deeper we find the dilemma apparent only. This will become clear when we consider the essential nature of knowledge.

The thoughtless among us may speak, for instance, of a red cow, and naïvely imagine we could prove our point with the testimony of a witness or two. But the philosophers have long ago made it clear that a cow would not be red but for the presence of someone to whom it looks red. Having established that point, the deeper of the philosophers go on to prove that the cow would not only not be red, but would not even exist, were it not for the presence of someone who thinks he sees a cow. In our argument the position is even stronger than this, for we have two lines of defence. First, we agree with the philosopher that you cannot prove of any given cow that it is red, or even that it exists at all; secondly, we insist that an idea is so much less stable than a cow that, even were the philosophers wrong about the cow not being red, they might easily be right about an idea not being right, or not existing. Take an example. The philosophers of the Middle Ages demonstrated both that the earth did not exist and also that it was flat. To-day they are still arguing about whether the world exists, but they no longer dispute about whether it is flat. This shows the greater lasting power of a real thing (whether it exists or not, for that point has not yet been settled) as compared with an idea, which may not only not exist, but may also be wrong even if it does exist.

II

We have now come in our discussion to the point where we see the absurdity of supposing ourselves to have any knowledge, as knowledge is ordinarily defined—or at least we would have come to that point but for lack of space which prevents us from making the subject really clear. However, it doesn't matter from a practical point of view whether you have followed this philosophical reasoning. Perhaps you are not a philosopher. In that case, and in the homely phrase of the day, I ask you, what's the good of an Englishman's learning first, that all Americans speak through their noses and secondly, why they do so, when he has to find out eventually that they do not? What's the good, again, of knowing that central Australia is a desert and that certain principles of physiography

make it so, when you may have to listen to an after-dinner speech by someone telling that it is not a desert ?

Such things do not always go in triplets of (1) so it is, (2) why it is, and (3) it is not—but that is a common order.

The reader may here protest that we are not getting much nearer our promised emancipation from the dilemma between our passion for system and the impossibility of systematizing knowledge. We have hinted above that the solution lies in finding a new basis for knowledge, and this we now proceed to do.

So long as you believe in them, the nasality of American speech and the desert nature of central Australia are fragments of knowledge capable of being arranged in a system. The trouble comes when you discover that they are ' untrue '.

This gives the solution of our problem. We must have knowledge that is incapable of being contradicted. On first thought this seems impossible, but on second thought we realize that such facts do exist in the domain of mathematics. Two and two make four.

But why do two and two make four ? Obviously because we have agreed that four is the name for the sum of two and two. That principle has been applied in mathematics to such advantage that it is rightly called the science of sciences; and this is the principle which, now at length, we propose to apply to all knowledge. Through it every science will become a pure science, and all knowledge as open to systematization as mathematics.

The trouble with facts, outside mathematics, has been inherent in the method of gathering information. We call these methods *observation* and *experiment*, and have even been proud of them—not realizing their clumsy nature, the unreliability of the findings, the transient character of the best of them, and the essential hopelessness of classifying the results and thus gratifying the passion of the human intellect for order and symmetry in the universe.

Take an example. A man comes from out-of-doors with the report that there is a red cow in the front yard. Neglecting for the moment the philosophical aspect of the case—as to whether the cow would be red if there were no one to whom she seemed red, and also the more fundamental problem of whether there would have been any cow at all if no one had gone out to look—neglecting, as I say, the deeper aspects of the case, we are confronted with numerous other sources of error. The observer may have confused the sex of the animal. Perhaps it was an ox. Or if not the sex, the age may have been misjudged, and it may have been a heifer. The man may have been colour-blind, and the cow (wholly apart from the philosophical aspect) may not have been red. And even

if it was a red cow, the dog may have seen her the instant our observer turned his back, and by the time he told us she was in the front yard, she may in reality have been vanishing in a cloud of dust down the road.

The trouble lies evidently in our clumsy system of observing and reporting. This difficulty has been obviated in the science of mathematics. A square is, not by observation but by definition, a four-sided figure with equal sides and equal angles. No one has denied that and no one can, for the simple reason that we have all agreed in advance that we will never deny it. Nay more, we have agreed that if anyone says that a square has three or five sides we will all reply in chorus: "If it has three or five sides it is not a square!" That disposes of the matter for ever.

Why not agree similarly on the attributes of a front yard?—making it true by definition that, among other things, it contains a red cow. Then if anyone asserts, for reasons of philosophy, colour-blindness, or the officiousness of dogs, that there is no red cow in the yard, we can reply, as in the case of the square: "If it does not contain a red cow, it is not a front yard!"

III

The author feels at this point a doubtless unwarranted concern that he is not being taken seriously. Or perhaps the plan proposed is not considered practical. But the proof of the pudding is in the eating. The thing has been tried, and successfully—not in the systematic way now proposed, but sporadically. Some instances are well known and convincing.

Take the assertion that a Christian is a good man. If you attempt to deny this on the ground that Jones, a deacon in the church, ran off with some public funds, your stricture is at once shown to have been absurd by the simple reply: "If Jones was a thief, he was *not* a Christian." A Christian is, not by observation but by definition, a good man; if you prove that a certain man was not good you merely show that he was not a Christian. Thus we have established once and for ever the fact that a Christian is a good man. It is like a square having four sides.

But if someone asserts that a Bolshevik, a Conservative, or a chemist is a good man, you can soon confute him; for the members of these classes have neglected to define themselves as good. Thus their attributes have to be determined by observation and experiment (after you have first run the gauntlet of the philosophers who ask whether the Bolsheviks could be good without the presence of someone who considers them good, and further whether any Bolsheviks would exist at all but for certain people who think they

exist). It is highly probable that evidence could be brought against almost any given Bolshevik and even some Conservatives to show that they are not good men. At any rate we have here no such clarity of issue as in things that are true by definition—as the four-sidedness of a square or the goodness of a Christian.

Through some experience of arguing this case in the abstract I have learned that its essential reasonableness can best be established from concrete examples. Let us, then, take cases at random from various fields of knowledge.

Consider first the ostriches of Africa. These birds have been studied in the wild by sportsmen and zoologists, and as domestic animals by husbandmen who tend them in flocks like sheep. There are accordingly thousands of printed pages in our libraries giving what purports to be information upon their habits. Besides being indefinite and in many ways otherwise faulty, this alleged information is in part contradictory.

Having studied the bird of Africa, let us turn next to the ostrich of literature, philosophy, and morals. Instead of the confusion in the case of the ostrich of zoology, we have clarity and precision. This is because the ostrich of literature exists by definition only. He is a bird that hides his head when frightened. You may too precipitately object that men would not accept universally this definition of the ostrich of literature if it did not fit also the zoological ostrich. The answer is that the definition has never received any support from zoologists, hunters, or owners of the domesticated birds, and yet it has been accepted universally throughout Europe since Pliny's time (about 50 B.C.). It has survived all attacks from science and from the bigoted common-sense of those who did not recognize its true nature. Like the definition of a four-sided square or a good Christian, it has survived because it was useful. Can you imagine any real attribute more instructive than the head-burying of the ostrich-by-definition? As a text for moralists, as an epithet that politicians use for their opponents, as a figure of speech generally, what could serve as well? Our literature is richer, our vocabulary more picturesque through this beneficent bird of hypothesis. He has many inherent advantages that no real bird could have. Since his habits are defined we need not waste time studying him first hand, nor in trying to adjudicate at second hand between books about him that disagree. Since he never existed as a beast he is in no danger of the extinction that is said to threaten the lion and swan.

Consider next what trouble we should get into if we did not have the literary ostrich and wanted to convey picturesquely the idea of that sort of wilful blindness from which we ourselves never

suffer, but which curiously afflicts our opponents. In pursuit of suitable analogy we might vainly canvass the whole animal kingdom. The ostrich-by-definition is, therefore, not only less trouble to deal with than a real bird; he is actually more useful and instructive than any real bird or beast. When we consider how often he has been used in sermon and precept we must admit that this model creature has contributed substantially, not only to the entertainment and instruction of nations, but also to the morality and general goodness of the world.

The ostrich is but one of several useful birds of definition. But we must be careful not to confuse these with real birds or their value is lessened. An example is the stork that brings babies. By a confusion of thought which identifies this stork with real storks, and through the pernicious birth-control propaganda which insists on rationalizing everything, the baby-bringing stork has ceased to be useful except in conversation with children, in the symbolism of the movie, and in the picture post-card industry.

The wolves of literature are among the most picturesque and useful of our definitions. Zoological wolves go in pairs or families, never above a dozen. It is obvious how inadequate this would be for modern movie purposes, where they should run in packs of scores or hundreds. Even in a novel or short story of Siberia or Canada you need packs large enough for the hero to kill fifteen or twenty, with enough left over to eat or to be about to eat his sweetheart. This is easily accomplished by employing a wolf of the general type we advocate—having no relation to the so-called realities but possessing by definition all the required characteristics (habit of running in packs of any desired size, willingness to eat, or attempt to eat, the heroine, etc.).

Another useful definition has long been that of Arctic, Canadian, and Siberian cold. The danger and disadvantage of confusing this hypothetical with a so-called real climate are best seen if we compare the facility with which people who have never been in these countries use the weather in conversation, speeches, and books, and contrast that facility with the awkwardness of travellers and natives. An example is a story by Tolstoi. Great as he was, he failed to realize the advantage in simplicity and vividness of postulating that Siberia is always cold, and actually allowed himself to be led into the artistic blunder of having the convicts in one of his novels die of sunstroke. An acquaintance of mine was filming this story. He realized the pictorial ease of 'putting over' drifting snow as compared with heat waves—the snow could be managed with confetti and an aeroplane propeller, but how would one photograph heat waves? But he realized still more clearly that the public is

wedded to the defined, as opposed to the 'real', climate of Siberia, and did what Tolstoi would have done in the first place had he lived in London—changed the scene from summer to winter, and then froze to death as many convicts as the picture required.

IV

These few examples from among many will suffice to show not only that the method of knowledge-by-definition is and long has been in standard use, but also that it has the advantages of being easily grasped, picturesque, and of a higher average moral value than the so-called 'real' knowledge. It is inherent in the genesis and nature of defined facts that they can be made picturesque in proportion to the ingenuity of the one who defines them, and as moral as necessary. This is a striking advantage over empirical knowledge, which cannot always be relied on to support the fashion of the time or even the moral system of the community.

It is from this last point of view that there has grown up in many countries of recent years a profound distrust of 'facts' and the theories deduced from them. In England such theories are dealt with by the simple and adequate way of paying little attention to the exposition of 'new' things. In the United States it has been found that the public listens even to the newest views, and sometimes actually wants to act upon them. This has necessitated the expedient of passing laws prescribing what may and may not be advocated and believed. These American laws are a step in the right direction, but inadequate because they do not have back of them any but specific moral considerations. Few people as yet realize the general reasons of expediency and broad sanity that lie back of the scheme we are here proposing.

Let us consider next a sample or two of knowledge-by-definition that could well be added to our present stock. Just as artificial tongues are built upon spoken tongues but avoid their mistakes, so may we conveniently base our knowledge-by-definition, or absolute knowledge, on what is already believed by some.

Assume, for instance, that all Irishmen are peasants holding land by insecure tenure from grasping landlords, that each has a pig under his bed, that everyone carries shillalahs, that kissing the Blarney Stone is the chief national occupation. Having agreed on these things, we could teach them in the schools of all countries. We should then presently all agree (on the basis of common facts) as to what our attitude toward Ireland should be, and the troublesome Irish Question would disappear from politics and history.

Think, too, what a charm the new system would lend to travel in Ireland! So soon as you landed you would note the rarity or

absence of all the things you had expected. You would meet surprise after surprise, which would not only delight you at the time but would give you material for endless letters home and for endless stories to tell when you got back. Thus would be built up an increasing tourist traffic, a source of revenue to Ireland itself and to the shipping and tourist companies of the various nations.

You may think such tourists, on coming home, would upset our system of facts-by-definition about Ireland. Not if that system is once thoroughly established. Consider in that relation the Greek pronouncement that at any time of year it becomes colder the farther north you go. North America is in language and civilization a homogeneous country in which one might think knowledge would therefore spread rapidly, and in which Atlanta, Richmond, New York, and Montreal are, and have been for a century, large and well-known cities that are by observation about equally hot in July. Yet there is even to-day practically unanimous adherence in all these cities to the Greek definition (" the farther north the colder at any time of year "), and each city believes those farther south to be hotter and those farther north to be colder, though thousands of travellers for a hundred years have found it to be uniformly otherwise. The ostrich with his head in the sand has survived two thousand years and is still ' going strong '. No human being can retain oil, but the hypothetical Eskimo drinks it by the flagon in our books and belief, and is none the worse for it. Then why should not all the world for ever believe that every Irishman has a pig under his bed ? All parties would benefit. It would be only the hypothetical Irishman that has the pig, and we could by hypothesis arrange that he should thoroughly enjoy it. The real Irishman would get the benefit of the increased tourist trade and surely he ought to be grateful. The tourist would make facile discovery of the non-existence of the pig; that would please him and interest all his friends for ever after as a sort of occult knowledge, like knowing privately that Indian fakirs are really no more clever than our conjurers, a pleasing secret now possessed and highly valued by many without detriment to the fakirs or to those who prefer to say they have seen them do marvels. Thus would everyone be the gainer.

V

It is obvious we could proceed along these lines to the development of a whole new system of thought and education. But we pause satisfied with having presented the germ of the idea. Once the point of view is attained, we feel sure the plan will develop in the reader's mind into a coherent philosophy helpful in solving the most difficult problems.

CURRENT INTELLIGENCE

PSYCHOLOGY IN AMERICA

Meetings.—The annual meeting of the experimentalists took place in Philadelphia during the week of April 15th. One of the interesting transactions, which are always informal, took the shape of an almost formal condemnation of the practice indulged in by many psychologists of sending out questionnaires to the members of the American Psychological Association for the purpose of obtaining information on various subjects. The sponsors of the complaint especially deplored the growing tendency on the part of graduate students who undertake research by circularizing professional psychologists.

It may be said that the questionnaire method is a necessity where statistical data are required, and will have to be resorted to, even at the expense of the busy psychologist; but the protest of the experimentalists is not without cause in view of the fact that the number of blanks—coming from many sources—to fill out is beginning to tax the patience of even the most accommodating.

Appointments.—Dr. Morton Prince has been appointed associate professor of abnormal and dynamic psychology at Harvard University, and will give advanced courses to graduate students and qualified undergraduates. Dr. V. A. C. Henmon, Director of the School of Education at Wisconsin, will be professor of educational psychology at Yale University, filling the place of the late Professor Chapman.

Congress of Philosophy.—The Sixth International Congress of Philosophy which is to be held at Harvard University during the autumn will bring several prominent European psychologists to America, in spite of the fact that the Psychological Congress will be held in Groningen at about the same time. Psychological subjects are provided for on the program of the Congress.

Publications.—Among the latest American publications in psychology are McDougall's *Abnormal Psychology*, Overstreet's *Influencing Human Behaviour*, C. K. Ogden's *The Meaning of Psychology*, Dorsey's *Why We Behave Like Human Beings*, Walstein's *The Subconscious Self*, Poffenberger's *Experimental Psychology* (Loose Leaf Laboratory Manual), Fryer's *Vocational Self-Guidance*, Kitson's *The Psychology of Vocational Adjustment*, H. E. Garrett's *Statistical Studies in Psychology and Education*, Sachs's and Hausman's *Nervous and Mental Disorders from Birth through Adolescence*, Myers's *Industrial Psychology*, Bousfield's *Pleasure and Pain*, Cole's *Factors of Human Psychology*, and

Book's *Learning to Typewrite*. The latter's *Psychology of Learning* which was originally published in 1908 has now been reprinted, but without any revision or additional material. Ruger's *Psychology of Efficiency*, which has been out of print for some years, has also been reprinted.

Influence of Immigration Laws.—Owing to the country's stand on immigration, a number of studies have appeared dealing with the intelligence of the foreign-born and with racial questions in general. These include Kirkpatrick's monograph *Intelligence and Immigration* and Miss Boody's *Psychological Study of Immigrant Children at Ellis Island.*

Popularity of Word 'Behavior'.—It is interesting to note that two of the books mentioned above stress in their titles the words 'behave' or 'behavior'. A popular magazine read by the large masses featured an article called *Why We Behave Like Idiots* (the writer apparently including himself in that class) and now the chief of the thoroughgoing behaviorists is making his views accessible to those who run, and in a series of articles he champions his cause against traditional psychology. Some time ago, the society readers of *Vanity Fair*, a fashionable journal, must have been somewhat perplexed to find an article on behaviorism by Bertrand Russell among their customary pabulum.

Theses.—The following dissertations have been accepted by the Department of Psychology at Harvard University in partial fulfilment of the doctorate: *Compensation for Inferiority*, by W. F. Vaughan; *Figure and Ground in the Visual Perception of Form*, by E. G. Wever; *Affective Habituation*, by J. Beebe Center; and *The Perception of Finality in Simple Tonal Sequences as Determined by Pitch*, by K. E. Zener.

Miscellaneous.—Several European psychologists are at present in this country, among them Ernst Kretschmer, author of *Physique and Character*, who has just been appointed Professor of Psychiatry at Marburg, C. K. Ogden, Editor of *Psyche* and of the *International Library of Psychology*, and M. Marcel Mauss, Director of L'Année Sociologique. Prof. Reymert, Editor of the *Scandinavian Scientific Review* has been teaching at Wittenberg College.

South America.—The death of Jose Ingenieros, the brilliant Argentine philosopher and psychologist, at the premature age of 48, which has robbed South America of its one eminent representative in psychology who could rank with the European leaders in that domain, has brought forth a volume of biographical sketches and abstracts of his most important works in the South American magazines and newspapers.

Mexico.—Dr. Pablo Boder, who after serving in the Russian Army during the World War, came to Mexico, acclimated himself, and advanced to the stage of being appointed on the teaching staff of the University of Mexico, is reported to have launched a psychological periodical in Mexico. He has been most active in educational and applied psychology.

A. A. ROBACK

INDUSTRIAL PSYCHOLOGY

The International Association for Psychology and Techno-Psychology (i.e. Industrial Psychology) began its official activity on March 15th. Fifteen European countries are represented in the Association, whose administrative headquarters are at Riga, under the direction of Dr. Moeller. In England, the Association is represented by Professor T. H. Pear, University of Manchester, and its department of Techno-Psychology by Dr. C. S. Myers, National Institute of Industrial Psychology. The first publication of the Association will be *A Survey of the Organization and Position of Techno-Psychology.*

CURRENT LITERATURE

Science and the Modern World, by A. N. WHITEHEAD (1926).

In the present stage of the development of science it is difficult to trace the course of any general change influencing the conceptions of every science. But there is at least one exception to this rule. This is the general tendency to dematerialize the notion of substance. While the truth of this statement need not be demonstrated in detail for the physical sciences, the evidence for this will be suggested in a moment. The interesting thing is that there is a somewhat parallel movement discoverable in the biological and psychological sciences. And the significance of this is great.

It is generally known that in the physical sciences ***matter*** is no longer thought of as being as ' material ' as the old Greek atomists supposed. We are all now quite familiar with the doctrine that matter or stuff or substance is only so much energy bound up in a rather stable form, and capable of being released—spontaneously released in radioactive transformation and perhaps some day artificially released in the laboratory, though the laboratory may be blown to pieces in the process. Einstein's theory of relativity also rests upon the idea that matter is simply bound energy. Professor A. N. Whitehead has taken a further step. In his *Science and the Modern World* he suggests that the electron is not a single bit of unchangeable stuff at an instant of time, but rather the electron *is* the vibratory ebb and flow of an underlying energy, with a definite periodicity.

One of the noteworthy achievements of modern science is the manifold ways in which contemporary physics and astronomy tie up with each other. As illustrating the new idea of the reciprocal convertibility of matter and energy we may point to the speculations of astronomers—such as Professor J. H. Jeans—who attempt to picture the conditions under which matter and energy may be transmuted into each other. Sir Oliver Lodge thinks that this process is a reversible one, whereas Professor H. N. Russell holds that irreversibility " is written wide and deep upon the face of nature", and therefore doubts whether the energy radiated out into space can again be converted back into matter as Professor W. D. MacMillan supposes. But the discovery of ' penetrating rays of cosmic origin ' by Professor R. A. Millikan has given added impetus to the view of Professor MacMillan. Sir Joseph Larmor has also expressed doubts concerning the permanence of substance.

Not to be outdone the chemists have also become sceptical about the reality of ' things '. For example, mercury, which was formerly conceived to be a single individual substance, is now thought of as an average of several rather similar kinds of stuff, namely, separate

isotopes of mercury, each having its own atomic weight. And to jump from this to psychology, perhaps the unity of the self (or *ego*) is but a statistical average (or 'central tendency') of the various selves or psychic isotopes. To return to physics, if matter is infinitely divisible as some have supposed, then every 'stuff' in the universe, including the electron, is only a synthesis of micro-events. Thus matter becomes a synthesis of motions!—But motions of what, you ask? Of nothings, of spheres of impenetrability in space-time, is the reply. Matter is non-matter in motion, is the answer of Karl Pearson. Matter is nothing other than a macroscopic or unitary mode of behaviour of microscopic movements.

Curiously enough, this same tendency to dematerialize 'substance' is also manifesting itself in the biological sciences. Some biologists now speak of chromosomes (the genetic units determining inheritance), which are ordinarily thought of as 'things', as 'packages of enzymes'. Moreover, enzymes, like hormones, are known chiefly through the results they produce—their energy transformations. Again, the evidence seems to indicate that vitamins are not so much chemical substances as they are centres of ultra-violet radiation. These facts seem to prove that things are simply their modes of behaviour. A stuff, then, is simply an 'orderly cluster of events', a unitary mode of behaving. This is a 'behaviouristic' view of nature.

One of the most interesting developments in this field lies in the study of the relation of organic things to the fields of radiant energy in which they are bathed and immersed. The influence of light of different frequencies on living tissue is engaging the attention at the present moment of both botanists and zoologists. Metabolism in plants and animals is controlled in a large measure by radiant energy, and the results which the future will bring to the front are likely to prove astonishing.

It is evident, of course, that the biologist still finds it convenient to speak in terms of the dualism of matter and energy. Certainly there is some difference between the *energy* of the nervous current and the *material* structure, the nerve fibre, over which it 'flows'. But perhaps this is only a difference of 'pattern'. Thus the pattern of motions involved in transporting coal from a mine to a blast furnace is different from the pattern involved in converting that same coal into heat energy. Similarly, the pattern involved in transporting energy from one part of the human body to another is different from the pattern of motions involved in building up the organism from the embryo to the adult. And yet there is a very intimate relation between all these kinds of motions. The term pattern is used in several different senses. Dr. Whitehead tells us that there are two sorts of change radically different from each other: there is vibratory locomotion of a given pattern as a whole, and there is vibratory change or deformation of patterns. How one type of change effects (or perhaps even builds up) the other type of pattern remains to be determined. Perhaps Prof. Charles M. Child's conception of 'physiological gradients' will eventually help us to understand the relation between patterns within individual organisms and the phylogenetic evolution of all living forms.

Even psychology is being modified by these changing views in physical science. Professor Charles S. Meyers believes that the tendency to dematerialize matter may make it easier to understand how the mind may influence the body through some energy interchange. The way in which the notion of 'pattern' is compelling a readjustment of psychological explanations is seen in the comparatively new movement known as *gestalt*-psychology.

All these various facts seem to indicate that the distinction between matter and energy is a relative one. Any piece of matter is an aggregate of 'energy knots' in the electromagnetic field. But what is energy, we want to know? Here we are ignorant. Energy is the possibility of change, of further evolution, one scientist tells us. Now if the astronomers are right in supposing that energy and matter are transformed into each other somehow, somewhere—perhaps in the interior of the hot stars or out in the interstellar depths of what seems to us to be the blackness of the night skies—then motions of one sort are swallowed up and disappear in motions of another sort. And the proper symbol for this fact is the serpent swallowing its own tail, the image which the Oriental mystics employed to symbolize eternity. Thus this all too solid universe melts, and dissolves into such stuff as dreams are made of.

O. L. R.

The Art of Thought, by GRAHAM WALLAS. (Jonathan Cape, 9/- net).

That so experienced a teacher and expositor as Mr. Graham Wallas should have so thoroughly exploited his psychological card-index for the benefit of his contemporaries is matter for congratulation. That the result should throw so little light on the 'art' in question is regrettable; and must be attributed chiefly to the fact that Professor Wallas seems to have omitted altogether from that card-index the entry "Definition, nature of", and to have been content with a few literary references for "Words, misleading influence of".

The relations of thought and language are, in fact, dealt with as though psychology had not got beyond the grammatical analysis of Aristotle, or at most the speculations of J. S. Mill and Max Müller. If the reader will compare the treatment of the intellectual and emotional aspects of language with that given in the corresponding passages in Mr. I. A. Richards's *Principles of Literary Criticism*, he will get some idea of the progress that has already been made beyond the point at which Professor Wallas so unaccountably stops.

On the other hand, we are given some illuminating notes on the processes employed by productive thinkers, and some suggestions for the better organization both of our own literary composition and of the training of potential thinkers and citizens. As collateral reading for the student the book is in many ways excellent, and like the writings of Mr. Havelock Ellis it will do a great service in introducing the general reader to the more serious problems of psychology.

A. M.

Imagination—Mind's Dominant Power, by BENJAMIN CHRISTOPHER LEEMING. (M. H. Schroeder Company, New York, 1926. pp. 288).

The Foreword by J. B. Jones describes the book as a " common sense statement of the principles of behavior", and according to the author the book is " an informal discussion upon ideation or ideaurgy, written to be read with due mental challenge by the greatest possible number of people". The book is certainly challenging and full of common sense, expressed in a clear, racy style. The author gives apt quotations and illustrious meant to show that there is still great room for progress in the biological sciences. He also makes a point of noting why a science like psychology has so far failed to answer questions of every day interest and importance. For him, psychology is pursued either as a positive science or as a normative science, and in both cases he thinks much good time is being wasted for " If it is a matter of inspiring individuals to higher norms or standards of behavior, the scientist must ever bow to the relative efficiency of religion," and secondly, because every cause or reason for human behaviour is based on a guess " and on account of slavish veneration for outworn terms, and an indiscriminate use of words, the guessing of scientists can never approach the freedom and brilliance of artists and poets." He makes several pointed criticisms of the disciples of the new psychoanalysis cult (p. 75, etc.).

The author rebels somewhat against " the traditions of the Superior Past " and he tends to flatter the average man. To him the true speculative philosopher or the real artist is the typical average working man, the grocer, the farmer. No doubt many of us dream and aspire. It requires, however, the trained reasoner and one capable of self-expression to stimulate others by his own dreaming and aspirations. Logic has its place even if the law of ideation, *contiguity*, is expected usually to hold true! The author himself remarks that this law must now and then be broken, for rebels, are at times essential if society is not to stagnate (p. 184 and p. 207).

Agreeing with James Harvey Robinson, Mr. Leeming brings " the Dramatic Situation to the aid of Psychology ", and very cleverly analyses several abridged stories. In so doing he also reconciles Pascal's disparaging description of Imagination with the extreme laudatory view of Ruskin. He also gives a very clear Chapter on the relation of Parts to the Whole, and shows how Enthusiasm without Imagination tends often to the perpetration of the absurd.

The author considers a man's behaviour to be based on a particular rôle, activated by a kinæsthetic sense receiving its stimulus from within and being the first sense to be acquired. Remembering that many developments in science originated from the choice of a suitable dscriptive word we must not grumble because ' kinæsthetic ' fails to solve the riddle of existence.

Consideration of life problems often leads to inconsistencies in expression of thought. Mr. Leeming on page 12 quotes John Langdon Davies with approval. On page 100 he strangely enough seems to agree with a misinterpreted passage from an essay by the

present reviewer. The reviewer does not see " a glowing promise of a Greater Day for mankind ", but agrees with those scientists who are " ringing alarm bells ".

J. K.

Amongst other recent publications we may note particularly Dr. S. A. Kinnier Wilson's *Aphasia* (*Psyche* Miniatures, 2/6 net), the second of the pocket Medical Series already announced in these columns, which, especially if read in conjunction with Part III of Professor Piéron's forthcoming *Thought and the Brain*, will serve to orientate the reader in this most perplexing of psycho-neurological disorders; Professor McDougall's *Outline of Abnormal Psychology* (New York, Scribner's 17/6 net), in which he deals—lucidly but not very adequately—with the Freudian view and other modern theories of the abnormal; and Professor Jean Piaget's *Language and Thought of the Child* (Kegan Paul, 10/6 net). The last named is one of the most original studies of the child mind that has appeared in the present century, and it is to be hoped that the translation of the companion volume on *Judgment and Reason in the Child*, which the author announces in his Preface, will not long be delayed.